

# Data Mining Early Warning System Based on Virtual Learning Environment

Yu Hua, Chen Juan, Ma Xiaohui

*Business College of Shanxi University, Taiyuan 030031, Shanxi China*

## Abstract

In this paper, multi-angle analysis of quantitative data mining warning system is completed, by using software engineering method. The study on the core issue of early warning is conducted, during divided the learning process in VLE platforms into three stages: former learning, study of middle and after learning. The studying route of core issues is: under the mode of Windows Server Apache, MYSQL and PHP (WAMP) built a learning platform, and by using asynchronous data pool to completes learning behavior of student data tracking in learning platform VLE. Meanwhile, a visualized statistical graph is designed and implemented, which can enter the presupposition condition for different object. That provides the evidence for warning analysis. Based on Android, EXJS, HTML5, PHP technology ,we design a questionnaire system, under VLE Virtual learning platform, to analyze after learning visualized warning, which facilitate further improve the quality of learning virtual learning environment.

Key words: DATA MINING,VIRTUAL LEARNING ENVIRONMENT,EARLY WARNING ANALYSIS

## 1. Introduction

As information technology applications in education, course information in higher education has become an indispensable teaching mode. When, the teaching network learning platform is run, we can get a large amount of data related student behavior by Web technology, which is the basic status of student in the curriculum information virtual network. The study of early warning system of data mining under virtual learning environment is optimization measures, which collects the original information of the student behavior in the digital virtual learning platforms and statistically valid on this data information. And finally optimization the regularity data, which can be implemented more targeted teaching and teaching management [1].

Domestic and international research on virtual learning environment data mining extraction the mea-

ningful information problems have made good progress. Where, the foreign educational data in detail in references: "Research on educational data mining from 1995 to 2005" and "Review and future of educational data mining in 2009". They are transverse demonstrate the recently data mining education literature review, while they describe the application that combining education data mining and educational system. It includes network teaching which based learning content management system, adaptive and intelligent, which gets data sources in these different platforms. It describes the statistical analysis, visualization, clustering (clustering, outlier analysis), forecast (decision trees, regression analysis and time series analysis), the relational mining (association rule mining, sequential pattern mining and correlation analysis) and text mining. In the course information data mining, the application of predictive mining, re-

lational mining and clustering mining are more widely [2] [3]. "Data mining technology in research institutions in the United States" comprehensive analysis the application of data mining when preliminary estimating the number of students enrolled, how to achieve university courses optimal set, how to help students retain the school roll and graduation statistics, and estimate the learning achievement [4]. "ID3 algorithm applied research in college admissions decisions," and "multi-class support vector undergraduate admissions process quality model of students". The research aiming at enrollment information data is mainly from the teaching management platform system rather than Web-based course information platform data mining. "Web data mining based on TV university online" explained Web log data mining in data mining, text mining and multimedia mining-based network content mining, web structure mining and Web usage mining [5]. "Web Usage Mining and Its Application in Distance Education Support Services" describes, in the remote digital learning platform, the analysis of students' learning behavior, learning frequency, contents and a residence period of learning etc. Through the analysis to find the special mode of students' access and manner in the digital learning platform, which guide students personalized digital learning support services [6]. In the context of online, "Learners Online Education Online Learning Behavior Analysis" conducted a survey and statistical analysis, by studying on students learning behavior, and applying educational statistics and cluster analysis. The above three papers are all completed in the context of online learning. The knowledge is mainly involved education statistics and visualization methods describing the behavior characteristics of the network to learn, but not related to the content of the data mining [7]. In summary, research at the present stage is obtain data manually in offline education system, or a small and single data mining analysis of online data, or a single questionnaire survey about network of teaching, or social network analysis methods, etc.. In this paper, we study the virtual learning environment early warning system of virtual learning environment based on multi angle quantitative analysis.

The innovation of this paper is the study on multi-angle quantitative analysis of the data mining warning system. In VLE platform, we gathered the students' user data, and then the data is processed. Find the warning through data mining. Finally, for early warning analysis, we conducted the interpretation, assessment and recommendations to improve and so on. The studying route of early warning is conducted, during divided the learning process in VLE platforms

into three stages: former learning, study of middle and after learning. The studying route of core issues is: in mode of Windows Server Apache, MySQL and PHP (WAMP) built a VLE learning platform data mining early warning system module, which by using asynchronous data pool to completes learning behavior of student data tracking in learning platform VLE. When researcher enters the different object or presupposition condition, it can statistic a visualized statistical graph in order to provide evidence for warning analysis. Based on Android, EXJS, HTML5, PHP technology, we design a questionnaire system, under VLE virtual learning platform, to analyze after learning visualized warning. At last, experimental analysis of early warning data mining is done.

## 2. System Analysis Process

This paper studies the analysis of warning system in accordance with the method of software engineering. We describes the overall framework, needs analysis and the main process of the study of key technologies.

### 2.1 Analysis of the overall framework

According to the three stages of virtual learning behavior (learning before, learning, and after learning), VLE data mining early warning system of the overall framework is analyzed. The whole early warning system is divided into two parts: a early warning module based on WAMP virtual learning platform and a demand of warning questionnaire investigation system based on a virtual learning platform developed by using Android technology. Three early warning objects of before learning are respectively registration, course selection and login, which warn of students learning initiative to VLE and information literacy. The warning objects of learning are building of learning resources and designing of learning activities. They can be refined as PPT, exercises, assignments, discussion boards and so on. That warns for the students' VLE virtual learning platform utilization. Android questionnaire occurs in the stage of after learning. At this stage, the data is collected via digital quantitative investigation. It warns VLE warning mainly from three aspects that is information literacy, VLE participation and satisfaction.

### 2.2 Key technology of early warning system

Redis data pool technology :In the WAMP virtual learning platform, the storage of students' learning behavior is realized based on Redis. Redis is open source, which uses the ANSI C language and support network. Its memory is Key-Value database based on the persistence log type and it available in multiple languages API. It is to a large extent compensate for the lack of such key / value of memcached store,

strengthen log storage speed and reduce the response time of the overall logic processing. Redis offers five data types: string, hash, list, set and zset (sorted set). Storage of Redis can be divided into three parts as memory storage, disk storage and log files, while the configuration file has three parameters to configure it. According to the characteristics of Redis, VLE platform establishes a transit center based on the log data of Redis, which is in the premise of researching and testing on Redis characteristics. It improves data processing efficiency and reduces data processing pressure in peak times. As a data dump point, Redis data pool can response to the request rapidly and warn analysis the data cache. It is not only efficient service data storage areas, but also to reduce server processing pressure of repeated counting. When 64G memory, 8 core, system kernel for the redhat server environment to build Redis server, the number of bytes stored is 2000bytes, storage in Redis just need 6ms and the amount of concurrent processing 25058res/s, the performance of the overall increase of the Mysql is nearly 50 times, so Redis memory performance is significantly more than Mysql in cache processing as shown in Figure 1.

Asynchronous request and background process: WAMP warning module simulates a lightweight Web Server, in the form of asynchronous request combines with a background finger daemonfinger, storing and analyzing log data. Extensive asynchronous request processing method processes dynamic data in front-end, loads and processes the data of services side.

That is, when the log storage request is initiated, the task completed is stored into Redis without any analysis and processing, requesting return immediately, then, complete the call. When monitor the data in Redis storage pool, the PHP script of finger daemonfinger in back-end server analyze the data of storage pool, according to the different needs. Use MYSQL database to detail data. While data is processed, the exception handling model is opened. The data incompatible will be stored in the MYSQL ERROR corresponding data table, which is waiting for manually handle. Strengthen the security of data by nature Redis floor storage and a master's from the security assurance model. The overall process of early warning data collection is when monitor VLE overall profile, introducing the log collection module, and asynchronous data is stored when request processing. The module based on early warning system data analysis, whose primary source of data is stored centrally in MYSQL detailed data. Data analysis by using PHP, statist the analysis results follow the rules. In this paper, the reason of adapting asynchronous and background processing is that it can achieve system efficiency meanwhile reduce server load. Redis asynchronous data pool plays a significant role in the data cache. Through calculating the results of the previous day's data analysis, they are stored in the pool, according to different rules and modules. Based on the needs, get data from data pool for further secondary processing, that is to meet the requirements of early warning data analysis module.

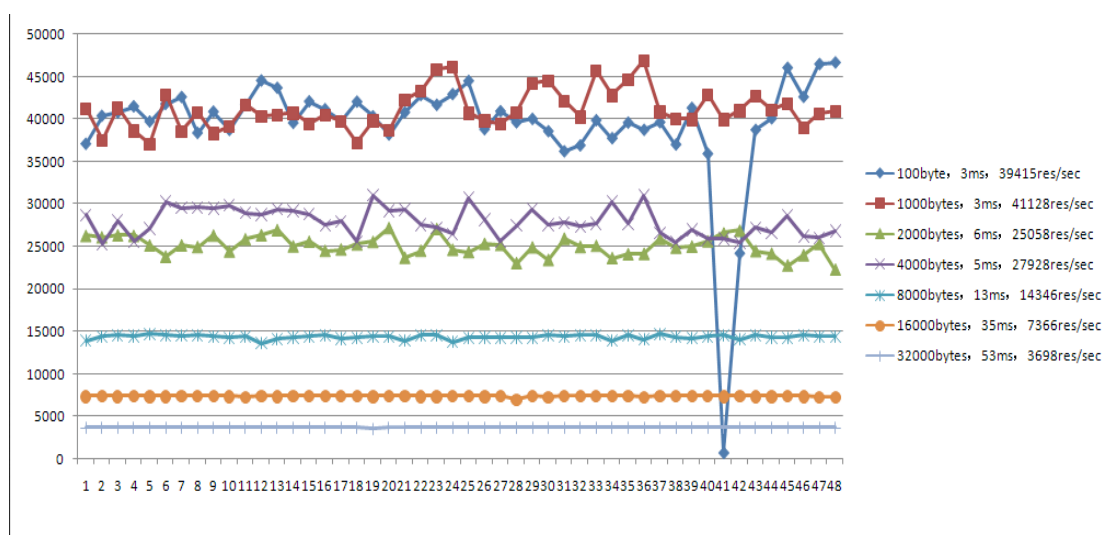


Figure 1. The Redis Data Tool Test

Two-dimensional matrix bar code: In the VLE data mining early warning systems based on mobile terminal, two-dimensional matrix bar code is used. Two-dimensional matrix bar code (known as a two-

dimensional bar code checker) is in a rectangular space with black and white pixels in a matrix of different distribution encoded. On the corresponding position in the matrix, the point (square dot, dots or

other shape) appears is represent a binary "1", the point does not appear to represent a binary "0". The permutation and combination of the points represent the meaning of two-dimensional matrix bar code. Two-dimensional matrix bar code is a new type of graphical symbols automatically read processing code system, based on computer image processing and a combination coding theory etc. Typical two-dimensional matrix bar code are: Code One, MaxiCode, QR Code, Data Matrix, Han Xin Code, Grid Matrix and so on. The mobile terminal entry of this system is two-dimensional code application. Design the browser page rendering of mobile terminal by using HTML 5 technology, which enhances adaptability. According to the local data storage features applying HTML5, graphical special effects, and integrated features to establish mobile browsing and support a variety of end of the collecting platform. In this paper, innovation technology of HTML is preliminary application, which is the initial step VLE platform overall migration to mobile terminals. The entrance of overall platform capabilities is slowly migrated, by using HTML to achieve some functionality the entrance of overall platform capabilities is slowly migrated.

### 2.3 Experimental analysis of early warning data mining system

The statistics and analysis of early warning learning behavior data before learning and learning : In accordance with the early warning process, the warning

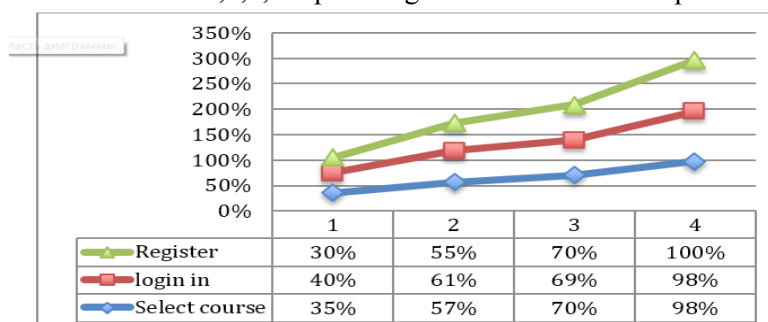
objects are determined based on the characteristics of information-based courses students learn behavioral in VLE. Set the alarm conditions for different objects, and clearly the research significance of the object. Finally, use the data of WAMP mode to track early warning modules in order to achieve statistical and analysis of early warning data. As shown in Table 1, before learning there are three warning objects: registration, course selection and login. We can get a statistics results for each objects, based on the registration success rate, course selection success rate and login frequency. The experimental verification is divided into 1,2,3,4 and a week's time to analysis. Statistical results are shown in Figure 1. In the first time, the success rates of registration, course selection and login are 30%-40% and the success rate of 20% or so, during the second time. In the third time, the success rate improves by 15% and in the last time, the success rate improves by 30%, which is basically reached 100%, which indicates that the students can successfully complete the VLE study preparatory activities before learning, ultimately. It reflects the students' good learning attitude towards virtual learning platform. Under the WAMP architecture, the changed data is analyzed, which are the effective access rate RI (Registration), SC (course selection), LI (login), AU (homework uploading), RD (homework download) of VLE warning objects. Figure 2 shows that it is at good level.

**Table 1.** Track the warning object, condition and significance of students' VLE learning behavior

Warning object	Presupposition condition	Significance
Registration	Registration success rates	Learning attitude
Select course	Course selection success rate	
Login	Login frequency	

The statistics and analysis of early warning learning behavior data after learning: The system analysis and verification based on the three major indexes, which are the students' smooth-degree, participation and satisfaction for virtual learning platform, as the basis for assessment of target questionnaire. As shown in Table 2, the statistical results 1,2,3,4 repre-

sents poor, middle, good, excellent level, respectively. Login warning system can implement statistical process of data, which shown in Figure. The mean values, displayed in Figure 3, are between 3.4 and 2.5 floating. Therefore, early warning system shows that the overall status of VLE course application is in the good and stable development trend.



**Figure 2.** Experimental analysis of warning objects interval fixed period of time

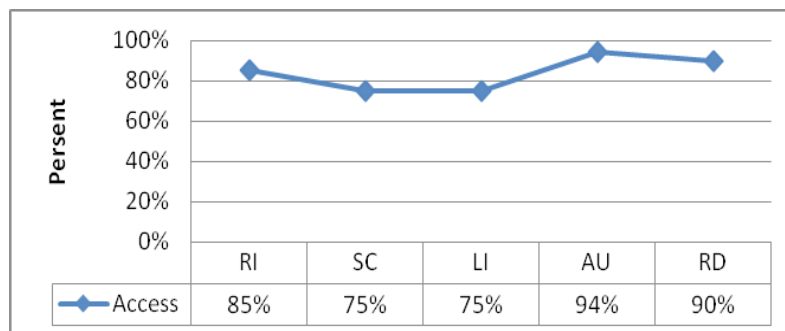


Figure 3. Effective access rate of VLE warning object under WAMP architecture

Table 2. Learning behavior analysis of early warning indicators in after learning

Warning Code	Index Detail	Answer setting
IQ1	Smooth degree of VLE registration, course selection and login	Four level: Very not smoothly, Not smoothly, More smoothly, Very smooth
IQ2	Smooth degree of learning process	
IQ3	Participation of courseware, exercises, code, etc.	
DP1	Participation of non curriculum direct related resources	Four level: Never participate, Occasionally participate, Participation more, Very much involved
DP2	Participation of operation of interactive learning activities	
DP3	Participation of platform forum Activity	
DP4	Satisfaction in VLE learning evaluation	
DS1	Satisfaction in the VLE interface design	Four level: Very dissatisfied, Not satisfied, More satisfied, Very satisfied
DS2	Satisfaction in learning resource information and maintaining	
DS3	Satisfaction with VLE teachers' guidance	

### 3. Conclusion

Starting from the practical demand, we use the software engineering method and the educational science research method to complete the research on the early warning system of the information-based courses under virtual learning environment. First of all, it applies literature method on the information-based courses, virtual learning platform and learning early warning system. Combined with teaching practice, it determines the needs analysis of VLE early warning system. Regard learning before, learning, and after learning as research stage, it designs and implements the warning module and the early warning system. Finally, the warning results are conducted in a certain university of Heilongjiang Province to validation and actual information programs warning analysis. The results show that the achievements can be used VLE early warning analysis for information-based courses of universities, which can provide a reference research ideas and results sharing for the study of high school information-based courses.

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## Routing Optimization Based on Artificial Fish Swarm Algorithm

Yue Zhao, Liying Du\*

*School of Computer Science and Engineering, Jilin Jianzhu University, Changchun130118, China*

*\*Corresponding author*

### Abstract

For multi-objective optimization in the QoS routing, this paper combines the artificial fish swarm algorithm and ant colony algorithm and tabu search algorithm, proposes a new improved algorithm, and delves into the application of solving the QoS routing. One main work in this paper is to put forward a mixed algorithm integrating artificial fish swarm and ant colony. Firstly, we randomly generate a network topology by the improved Salama algorithm. Secondly, we find out many feasible paths that satisfies constraint conditions by the parallel search feature of ant colony algorithm. Thirdly, we create the alternative path set. Lastly, we use artificial fish swarm algorithm to solve the optimum multicast tree in the created alternative path set through the foraging, bunching, tailgating, and other behaviors. The other main work in this paper is to put forward a mixed algorithm integrating the artificial fish swarm and the tabu search. Firstly, we divide the region needs to be searched into several sub regions and rapidly solve suboptimum solutions in each sub region with the fast convergence capacity. Secondly, we solve suboptimum solutions in each sub region by taking suboptimum solutions as initial solutions in the tabu search algorithm. Thirdly and lastly, we sort the optimal solutions in each sub region with the bubble sort and thus solve the global optimal solution.

Key words: QOS ROUTING, ROUTING OPTIMIZATION, ARTIFICIAL FISH SWARM, TABU SEARCH ALGORITHM, SUBOPTIMUM SOLUTION

### 1. Introduction

With the expanding network scale and application services, especially the emergence of multimedia application technology, as well as the demand of inte-

ractive application services, the Quality of Service (QoS) has set a higher demand on the network. Due to the rapid development of network and widespread use of distributed multimedia, QoS with higher stan-