Study on academic Early Warning System for Information Engineering Vocational students

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Abstract. Due to the expansion of higher vocational college enrollment, the different quality of students and the high quality requirements of enterprise talents, this paper proposes an academic early warning system for higher vocational college students, which can be used for the early warning of students' performance and improve the teaching quality. Firstly, the clustering algorithm is analyzed, and the parallel K-means algorithm is adopted in the general algorithm. During the startup and running of the program, the processing time of the algorithm is short and the total consumption of the system is small. Compared with the existing data mining technology, parallel K-means algorithm has good practicability and flexibility.

1. Introduction

1.1. The enrollment expansion matriculate quality
The popularization of higher education has provided more students with opportunities to enter institutions of higher learning for education. It has also accelerated the training of all kinds of technical talents needed for the country's development, and enabled more young people to realize their value in life by virtue of their professional skills. In 2019, the State Council approved the Implementation Plan for the Special Work of Higher Vocational College Enrollment Expansion, and decided to expand enrollment of one million higher vocational students by adopting a wide and strict education approach.

The purpose of higher vocational enrollment expansion is to solve the employment of ordinary people, popularize higher education, and fill the vacancy of social and technical personnel. This is not a short-term task, but a long-term strategy. Therefore, higher vocational enrollment will continue to be expanded in 2020. Higher vocational students include veterans, secondary school students and vocational school students. The wide enrollment leads to the deterioration of students' quality. In order to improve the quality of graduates, it is imperative to establish an academic early warning system [1].

Every school has an educational administration management system, but this system can only passively check students' performance, cannot give students early warning of their studies, cannot reach the role of a warning for students, so the school needs an academic early warning management system. School early warning management is such a kind of management mode, it through the school, students and parents of multilateral communication and cooperation between the students in the learning of impending problems and difficulties for emergency tip or told in advance warning will be towards the state of the learning process and possible adverse consequences, and take some corresponding preventive measures, strengthen the guide of students learning situation, monitoring,
prompting students complete their studies [1]. Early warning management can help students improve their independent learning ability and learning management ability, and is also an important guarantee for the construction of school campus study style and the improvement of teachers' teaching quality.

1.2. Put people first
People-oriented, the core is "people", is the core of the scientific concept of development. Academic early warning management reflects the core value of "taking students as the foundation", that is, students are developing people, students are unique people, students are independent people, reflects the humanized management of students, school care for students, education effect of the whole process. Through academic early warning, students can timely know their academic situation, timely adjust their learning methods and bad habits in the learning process, face various problems in their studies, overcome difficulties, solve problems, and improve their performance.

In the past, students' academic performance was not satisfactory, usually the school's approach is to repeat credits or drop out of school, students failed to respond, they have already dealt with, will cause students have psychological impact on their studies, the management system to deal with inhuman. Now, through the study early warning management, change the traditional study management mode, the study can carry on the advance prevention, the event early warning, after the help of the management mode, can fully consider the interests and development of students, student-oriented, change the elimination rate of students, promote good teaching cycle.

1.3. Establish a four-dimensional communication platform of "enterprise - student - school - parent"
Schools are the teachers of higher vocational education, students are the recipients of higher vocational education, enterprises are the practitioners of higher vocational education, parents are the partners of higher vocational education. Academic early warning management work needs multi-collaboration, parents need to care for the growth of children, sometimes busy work, can not understand the academic situation of students, or when things are serious, students repeat grades, drop out, can not graduate on time, parents know, for the growth of students cause adverse consequences. School early warning management, to build "enterprise - students - the schools - parents" four dimensional communication platform, helping students, the school can be in the process of students' learning told in advance warning of impending problems to the four winds, students can find problems in time, the enterprise can grasp the students master knowledge technology, parents can in time for students' academic situation, schools, enterprises, parents tripartite cooperation, aiming at the problems, take corresponding measures, undertake to the student education, in order to prevent students deviating from the normal track.

1.4. Establish early warning system to improve the quality
The school is a big family of teaching and educating people. I hope all students can graduate smoothly and make contributions to the society with excellent results. Improve the quality of teaching, the pass of graduation, start school early warning management, based on the academic status of poor, helping students, standardize the behavior of students, improve the learning initiative and creativity, through academic warning warning role, the academic achievements are timely into qualified even good students, stable and student employment rate, improving the quality of graduates.

2. Theoretical basis

2.1. Academic warning system
The academic early warning system consists of the following technical steps: Using the idea of natural data classification, the data of similar distances are divided into categories, which are classified as excellent, qualified, failed and passed. The head teacher can query the students who need early warning through this system, analyze the subjects of early warning, remind and supervise the students
to do a good job in course learning. Companies can query excellent students, teachers can query related courses, and parents can learn about students' academic performance.

2.2. Clustering algorithm
The clustering algorithm is divided into supervised learning and unsupervised learning, and the k-means algorithm is used the longest. This algorithm first randomly selects K objects as the centroid of the initial K clusters, then assigns each remaining object to the nearest cluster according to its distance from each centroid, and then recalculates the centroid of each cluster. This process is repeated until the criterion function converges [2]. The usual criterion function is squared error and criterion function, namely SSE(sum of the squared error). The transformation formula is as follows:

\[ SSE = \sum_{i=1}^{k} \sum_{p \in C_i} ||p - m||^2 \]  

In Formula (1), the sum of the squared error of the data can be obtained, P is the data object, Mi is the average value, through this formula, the generated results can be compact, easy to judge the data.

2.3. The algorithm process
Select a student from the School of Information Engineering, divide the students into four groups, and select the student number, course number and grade data for analysis.

2.3.1. We obtain the scores of students from the School of Information Engineering in the Teaching and Scientific Research Department. The data information mainly includes students' names and student Numbers. Course name, course number, instructor. Test scores, test time, and credits. The experimental data here is mainly to check the students failed, there is the possibility of make-up examination, to provide early warning to the students who failed. The data collection part of this early warning system mainly collects student Numbers, course Numbers and test scores [3].

2.3.2. The collected data is sorted out and invalid data is removed. These courses include optional courses, such as second class and elective courses, which are screened out. There are also special fields, such as gender and telephone number. The fields that do not affect test scores are also filtered out.

2.3.3. Organize the data and start the calculation of the data.
Data processing is based on student number, course number and student score. We can combine the student number and course number into a matrix, and the matrix value represents the student's score. The data form is as follows:

\[
S = \begin{bmatrix}
S_{11} & S_{1b} \\
... & ...
\end{bmatrix}
\]

In formula (2), the matrix is represented by S, a stands for the number of students, and B stands for the number of courses. In these data, the average score and failure rate of students are calculated. These two eigenvalues are used as the basis for clustering.

\[
A_i = \frac{\sum S_{iy}}{num(S_{yi})}
\]  

(3)
In Formula (3), the average value is replaced by the first letter of English words, and the total score of students is calculated. Then, the average score of students is obtained by dividing the number of courses. The failure rate is calculated by dividing the number of failed courses by the total number of courses. The formula is as follows:

\[ F_i = \frac{\text{num}(S_i < 60)}{\text{num}(S_i)} \times 100\% \]  

(4)

The value in formula (4) is the course score.

2.3.4. In the experiment, we divided the students' scores into four levels: failing, passing, good and excellent. The early warning system mainly presents the situation of failing, so there are two levels of failing, failing or failing. Considering the above situation, in the clustering, the number of Settings is four [4].

2.3.5. Algorithm operation.

Input the average score and failure rate of students into the system, set the input and output paths in the program, and start the operation [5].

3. Early warning system requirements analysis

The diversity of school curriculum types, as well as the exchange of credits for certificates and certificates. The exchange of credits for both specialized and undergraduate courses leads to the diversity of score statistics. Parents need to know about students' courses, head teachers need to keep abreast of students' trends, students need to inquire about courses, enterprises need to know about excellent students, and so on.

Under the background of higher vocational college enrollment expansion, facing the sharp increase in the number of students and the decline in the quality of students, the need for accurate early warning of students' performance has become an urgent problem for our school to solve. Therefore, academic early warning system is particularly important for head teachers, teachers and parents to manage students. Therefore, we use clustering algorithm to calculate students' average score and failure rate, so as to better understand students' academic performance.

4. System design

The overall design of the academic early warning system is divided into four parts: application layer, data access layer, data layer and resource layer [6]. These parts are detailed according to the functions of the early warning system.

Application layer: This part mainly manages the early warning data, early warning information, early warning data mining and the whole system.

Data access layer: mainly relates to data, obtains access rights through login authentication, and applies data mining technology to analyze data.

Data layer: it is mainly related to database, including user information database, system information database and academic sensitive information database [7].

Resource layer: mainly hardware and software facilities. Our school has a professional network center and an exclusive operation platform to provide guarantee for the academic early warning system.

5. The results of the test

The average score and grade level of the four groups are matched. The average score difference between the first group and the third group is large, and the failure rate difference is obvious. In particular, the failure rate of the first group is 0.19, and the failure rate of the four groups is 34.387,
indicating that the k-means algorithm has obvious clustering effect [8]. The specific information is
shown in Table 1:

| Cluster number | Cluster center         | Number of samples in cluster |
|----------------|------------------------|------------------------------|
| 1              | (84.487, 0.19)         | 305                          |
| 2              | (77.387, 1.451)        | 272                          |
| 3              | (71.804, 12.574)       | 105                          |
| 4              | (60.362, 34.387)       | 32                           |

6. Conclusion
This paper puts forward a kind of information engineering school of higher vocational students early
warning system, it is a combination of clustering algorithm, database technology, through the analysis
of the data mining technology to realize data, sorting and early warning. The experimental results
show that the clustering value is 4, which has a good effect. It can clearly distinguish the average score
and pass rate, and at the same time, it can warn students about their grades. In addition, this algorithm
adopts parallel K-means algorithm, which has short processing time and less total system consumption
during the program startup and running. Therefore, this method has good practicability in practical
system development.

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