Design and Implementation of College students' Physical Health Test System based on Data Mining

Li Min

Department of Student Affairs, Shandong Vocational College of Light Industry, China

liminteacher@126.com

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Abstract: With the continuous development of social production and the continuous progress of science and technology, all walks of life in the society have higher and higher requirements on the ability level of talents, and gradually change from single ability dominated by simple intelligence factors to diversified ability. At this point, as an important university of talent cultivation, it is necessary to carry out real-time monitoring of college students' physique and effectively cultivate their physical quality. In order to achieve this educational goal, it is necessary to monitor the health status and physical quality of college students in real time, so as to find problems in time and adjust the training program and method. Therefore, how to carry out real-time monitoring of college students' physical health, collect and process the system information of college students in a standardized way, and find problems from this information to further provide help for decision makers has become a new challenge facing researchers.

1. Data mining technology

1.1 The concept of data mining

With the development of Internet, science and technology level is also increasing day by day, people have the data in the continuous increase, the storage of these data needs to use the database, so the capacity of the database also needs to continue to expand. But for the current application, the application of the database is mainly focused on simple data management and simple data query. With such a huge amount of data, there is a lot of meaningful information hidden in it, and the database system is difficult to complete. [1] Data mining technology is produced to obtain valuable information from complex data.

Data Mining is a process of extracting potentially useful and credible information and knowledge hidden in a large amount of raw Data, which is incomplete, noisy, fuzzy and random.

The characteristics of data mining include: massive data, huge data sets, discrete variables, available rules, dynamic rules and relativity of rules.

1.2 Function of data mining

Data mining technology mainly includes two basic functions: description function and prediction function. The goal of data mining is to discover hidden and meaningful knowledge. [2] At present, data mining integrates various technologies and is divided into more functions. The functions of data mining technology can be further subdivided into the following functions:

1) Data Summary

Data summary is derived from the unified analysis of data analysis. The main purpose of data summarization is to compress the data. The methods used for unified analysis include mean value, variance value, etc. At the same time, we can also use graphs to intuitively summarize the data, such as histograms, pie charts and so on. In addition, multi-position analysis can also be considered as a data summary in data mining.

2) Classification

The main purpose of classification analysis is to construct classification models or functions. The classification model predicts categories by mapping each data item in the database.

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3) Clustering

Cluster analysis is done by dividing databases into different groups. When grouping, the data between a group should be as similar as possible, so that there are obvious differences between groups. [3] Cluster analysis is now widely used, but different from classification analysis, it is usually used to subdivide data.

4) Association analysis

Association analysis is mainly used to find the correlation of data in the database. The two main techniques of association analysis are sequence patterns and association rules. The sequential pattern is to look for the degree of correlation between two events in time. Association rules look for the degree of correlation between different attributes in an event.

5) Prediction

Predict future trends by analyzing existing data patterns.

6) Deviation analysis

Bias analysis is the analysis of extreme and rare cases of data in order to discover the underlying causes. That is, the analysis of data anomalies, so as to obtain valuable, potential information.

1.3 Data mining process

Data mining is a complex and progressive process of data processing. From the perspective of data itself, data mining usually requires four processes, including problem definition, data preparation, data mining implementation and data interpretation and evaluation.

1) Definition of problem

The first step of data mining is to recognize the goal of data mining, so it is necessary to define a clear mining object, at the same time to understand why data mining and the goal to be achieved.

2) Data preparation

The most original data in data mining is data. The large database size makes data inevitably appear noise, singularity, duplicate data and null value, which will have a bad impact on the results of data mining. Therefore, in order to solve these problems, data preparation is required. The only way to find value is to use the right data.

3) Implementation of data mining

The main step of data mining is to establish a data mining model by using various data mining algorithms and techniques according to the prepared data. However, for specific tasks, it is necessary to analyze the characteristics of data, so as to select the appropriate algorithm to build the data mining model and solve the corresponding problems.

4) Data interpretation and evaluation

The ultimate purpose of data mining is to analyze existing data information, extract valuable information and present it in a visual way, so as to help solve practical problems. The results can then be interpreted and evaluated in terms of correctness, usability, understandability, etc. [4] Only after the interpretation and evaluation of data, data mining can be truly applied in practice.

2. Demand analysis and frame design

2.1 Overview of system

The purpose of the design of student physical health test system based on data mining is to provide effective and efficient management for student’s physical health test in universities. The system designed in this paper integrates the modules of system management, student management, test management, data analysis W and student interaction, realizing the efficient management of students' physical health test. Specifically, the system management module realizes the management of system administrator information, system backup information, system internal information and feedback information received by the system. The student management module realizes the management of student information. The test management module realizes the management of tests, which details the whole process of test establishment, release, execution, obtaining results and generating feedback from the results. The data analysis module realizes the overall analysis of test

data and provides support for decision-making. The student interaction module realizes various functions of interaction between students and the system. In this system, data mining algorithm is integrated to analyze the data after students participate in the test and obtain a series of rules related to students' physical health, which provides data support for decision-makers to formulate students' physical education courses or related physical exercise plans.

2.2 System demand analysis

2.2.1 System functional requirements

The purpose of the system design is to be able to effectively manage students' physical health test, among which the functional requirements of the system include the following points:

(1) Able to add, delete and modify student information;

(2) Support the batch import and export of student information;

(3) Automatically complete data analysis according to the given conditions;

(4) Students can browse the test information released by the system;

(5) Students can make an appointment for a test, and repeat the appointment if they fail the test;

(6) Students can check their scores after the test.

(7) The system supports the retention of students' test data at any time;

(8) The format of test data between test instruments should be consistent;

(9) Support the permissions of different users in the system;

(10) The system supports the release, modification and deletion of notices and messages;

(11) The system supports the addition, modification and deletion related to testing;

(12) Support data query operations based on various conditions;

2.2.2. System nonfunctional design

In addition to the functional requirements of the system, in the system's reliability, availability, and performance, the system should also meet the following non-functional requirements:

(1) Convenient and concise interface;

(2) High stability;

(3) Support 8-20 people to conduct tests at the same time;

(4) The system is robust enough to deal with various unexpected anomalies;

(5) The system security should be high; the system data should not be damaged;

(6) The response speed of the system should be fast, and the response time to user operation should be short.

2.2.3 System faces the customer

The system mainly faces four kinds of users in the running process:

(1) Students

Students are the main user group facing the system. Students can use the system to make an appointment for the test, inquire the test result and submit the feedback information of the system.

(2) System manager

The system administrator is responsible for the maintenance and management of the system. [5] All test information in the system is manually set by the administrator, and the release of information, processing of feedback information and data analysis operation in the system are handled by the administrator.

(3) Super manager

Responsible for adding, deleting, and modifying system administrator information.

(4) Developer

Developers are responsible for implementing daily updates and maintenance operations to the system from the code level. After the system administrator receives feedback from the user, if the information is relevant to the underlying implementation of the system, the problem is referred to the system developer. Through the continuous maintenance and upgrading of the system, the developers ensure the usability and ease of use of the system.

2.3 System design

2.3.1 Principle of System architecture design

The principles to be followed in the design process are described below:

(1) The system is functionally complete. After the requirements analysis stage, all functions needed to be realized by the system need to be clarified, and each function should be mutually exclusive and non-redundant.

(2) The system is easy to use. The system should meet the needs of various users.

(3) The system is maintainable and expandable. The system should be continuously upgradable and maintainable, which can constantly correct errors and upgrade existing incomplete functions.

2.3.2 System architecture

The system in the traditional Browser/Server (Browser/Server) architecture has been extended, adding students' physical instrument testing terminal.

3. The design Outlines

This chapter mainly describes the general design of the student physical health test system based on data mining, including the detailed structure diagram of each module in the system and the business process of each functional module. [6] From the architecture design of the system, we can see that the system is divided into two modules: system service and student interaction. The system service can be further subdivided into four modules: system management, student management, test management and data analysis. The detailed structure, main functions and business processes of each module are described below.

3.1 System management module

The system management module mainly realizes various management operations related to the system. Its module structure is shown in the figure below:

System management module; System administrator management module; System backup; System information management module; Feedback information management module; System management module structure diagram.

As shown in the figure above, the system management module mainly includes four parts: system administrator management module, system backup module, system information management module and feedback information management module.

3.2 Student management modules

The student management module is mainly responsible for the management and maintenance of student information. The module structure diagram is shown below:

3.3 Test management module

Test management module is the main module of the system, including six sub-modules, including test project management, test task management, test plan management, test plan project management, test instrument management and test data management. Below is the specific structure diagram of the test management module.

The test management module consists of five types of entities: test project, test plan, test plan project, test instrument, and test task.

(1) Test project

Test projects that students need to attend various test projects, such as height, weight, chest circumference, pulse, blood pressure (systolic/diastolic blood pressure), lung capacity, 50 meters, standing long jump, pull-ups (boy), a minute sit-ups (girl), grip strength, the 800 - meter run (girl), 1000 - meter run (boy) in succession, crook proneness, etc. [7]

(2) Test plan

The test plan is the plan made by the system administrator for each grade, in which different plans contain different test items, and the standards for test items related to scores are also different.

(3) Test plan item

The test plan project is the correspondence between the test plan and the test project. A many-to-many correspondence can be established between the test plan and the test project. For each test item, there are differences in the achievement criteria in different test plans.

(4) Test equipment

Testing instruments are the instruments involved in the physical testing of students. For each test instrument, the system mainly records the name of the instrument, the corresponding test item and the adding time of the instrument.

(5) Test tasks

The test task refers to each test task that the student wants to reserve for participation. The test task mainly includes the name of the test task, the corresponding test project and test instrument name, the date of the execution of the task, the start time, the test duration, the test status and other information. After the execution of the test task, the system automatically changes the test state of the task to itself.

3.4 Specific analysis modules

The main function of the data analysis module is to receive the test data provided by the test data management module, evaluate the test scores of students, further generate reports and provide support for decision-making.

4. Summary

The system designed in this paper mainly includes two major modules, system service module and student interaction module. The system service module realizes various operations within the system, while the student interaction module realizes the interactive operation between students and the system. The system service module includes system management module, test management module, student management module and data analysis module. The system management module mainly realizes various management operations of the system, which can be further subdivided into system administrator management module, system backup module, system information management module and system feedback information management module. The test module mainly realizes the management of various test entities in the system, including test project management, test plan management, test plan project management, test instrument management, test task management and test data management. The student management module mainly realizes the management operation of student information. The data analysis module mainly realizes various analysis work of test data, including performance evaluation, report management, test result query and decision support.

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