APPLICATION OF MACHINE LEARNING IN DISTRIBUTED SENSOR NETWORKS

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Abstract

The advancement of artificial intelligence has spurred changes across numerous domains. This paper will examine the information management technologies used in colleges and universities using distributed sensor networks and machine learning. Rather than forcing the teaching management concept upon instructors, the goal of teaching management is to most efficiently increase the quality of instruction. However, in teaching management, the efficacy and quality of the job are disregarded, which results in an increased workload in teaching management. In order to achieve the centralised processing of a substantial amount of data in the teaching management process, standardise the management procedure of the teaching management department, and increase the operational efficiency of the teaching management scheme, the paper will employ the distributed sensor network communication method. The study constructs a distributed sensor network teaching management module, which is primarily used to analyse the key elements impacting students' performance and identify strategies to reduce learning issues. It also applies information technology to teaching management in colleges and universities.

Keywords: Machine learning, Artificial intelligence, sensor networks, Centralised process.

1. Introduction

The primary means by which higher education institutions cultivate the multitude of highly skilled individuals that society requires is through teaching. Since teaching is unquestionably the primary function of colleges, teaching management has evolved into the dominant theme of college administration. The ability to use information technology effectively is necessary to handle the

increasing workloads and challenges at work. Clearly, with information technology being used so widely in today's world, college teaching management is becoming more and more reliant on it.Many colleges and universities have progressively introduced modern information technologies, such as computers and network communication, into teaching management to improve the teaching process in order to adapt to the rapid development of higher education and the gradual advancement of the credit system teaching reform.

Teaching management still needs people to manage, and it is not the same old set of management. Urick MJ used film as a teaching tool [1]. Anne explained the Student Evaluation of Teaching (SET) score [2]. Solomon V V believed that teaching management contributes to better outcomes [3]. Yu K proposed an adaptive teaching-based optimization (SATLBO) [4]. Latief S teaches according to the BDR policy, which enables educators at private universities in Jambi to conduct teaching management according to their expertise and knowledge without a Learning Management System (LMS) [5]. The teaching management scheme they put forward has no good effect on improving the teaching quality. For this reason, this paper adopts distributed sensors to improve the information construction of teaching management.

With the development of distributed sensor networks, the data that can be collected has become more and more abundant and accurate. Combined with the matching evaluation system and the synchronous establishment of related APP application software, such intelligent sensor equipment can enter the teaching management of colleges. Li K explored the concept of IoT [6]. Faraji M M proposed a new fuzzy-based distributed sensor node sound source localization algorithm [7]. Lou W used the principle of information distribution to propose an information filter [8]. Arce F studied the distributed signal estimation problem in WSNs [9]. Abdellatief W believed that inter-node communication in WSNs is important [10]. Distributed systems often rely heavily on network communication protocols, which require multiple interactions to accomplish their tasks, as will be explained in a further post on distributed sensor networks.

Ensuring the improvement of teaching management level and promoting the improvement of talent training quality are also problems faced by colleges in recent years. This paper has established a shared resource pool to pool and manage the educational resources of the whole school. Distributed sensor network technology is used to perform data storage and query operations, integrate various advantageous teaching resources, and carry out platform-based management, breaking the constraints of traditional teaching time and space, and providing a stable and reliable background for college teaching management. Data management guarantee; in addition, independent course selection is carried out according to the actual needs and interests of students, which improves the user adhesion and data search rate of teaching management.In this research, the correlation coefficient of the

indicators to other indicators is less than 0.35 in the variable measurement, and the number of times of changing the information system is changed in the evaluation of "informatization level of teaching management in colleges". After this indicator is deleted, the alpha value is increased to 0.738. In addition, the Academic Affairs Office of M University takes computer operation ability as an important indicator when selecting personnel. There are as many as 10 teaching management personnel with computer professional background, which reflects a high level of information technology talent construction.

2.1 Design of Teaching Management Structure in Colleges and Universities

2.1.1 University Teaching Management

The overall structure of the university teaching management scheme is shown in Figure 1. Teaching management program:

1. Complete all kinds of data processing of teaching management.There are the registration of operators, the modification of personal information, the verification of identity, the release of information, the arrangement and review of teaching plans, and a series of management of teaching plans.

2. The secondary management of teaching departments and offices, including verification of personal identity, inquiry of teaching plan, information viewing, management of faculty and staff of department, course inquiry, summary, and plan formulation [11].

3. Teachers' online input to formulate teaching plans and release, input of test scores, information modification and query services. After the examination is scored, the system administrator can immediately export the data of score analysis, and teachers can develop and modify the teaching method under the guidance of these data, find problems, and greatly improve the disadvantages of difficult to find problems in the teaching process. The marking system has greatly liberated teachers' workload. Data analysis helps teachers to discover problems in the teaching process, timely discover the progress and decline of each student, as well as the major and difficult points in students' learning. Teachers can carry out targeted guidance in the teaching process to improve teaching quality and student achievement.

4. Students use the teaching management scheme to conduct online: personal registration, information maintenance, online course selection, viewing notices, and results query [12].
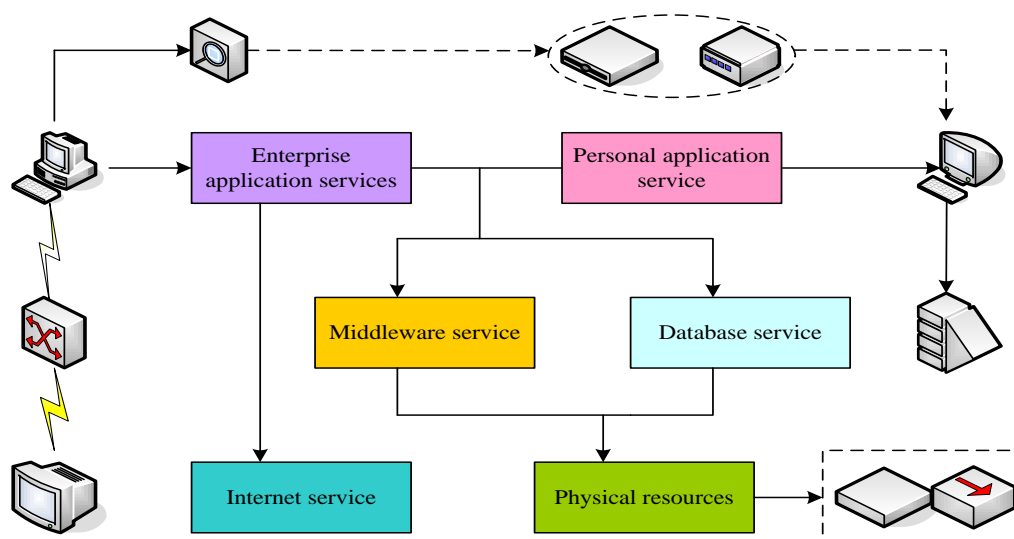
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Figure 1. Overall architecture of the university teaching management scheme

2.2 Distributed Sensor Network Information Technology

This paper plans the main functions of the teaching informatization management plan that need time,strengthens and highlights the function realization of the core business processing module of teaching management, and meets the needs of various departments of teaching management. Distributed sensor network mentioned in the research has high advantages in improving the performance of teaching management system.Through the distributed sensor network, people manage the network hierarchically, and the use of hierarchical design structure can reduce the energy consumption of data transmission in distributed sensor network compared with the traditional structure. China's wireless sensor network application research started almost simultaneously with developed countries.

But even if it is a hierarchical structure, the divided levels will consume the energy in the network due to the data transmission between the levels. Only using the hierarchical structure can not satisfy the optimal design of the network. The entire life cycle of a sensor network revolves around the management and processing of data. Only when the data is accurately stored and available for user query, and the user can deal with the relevant work in time according to the situation reflected in the data, can all the functions of the sensor network be completed, which is also the ultimate goal of the sensor network application [13].

Let the measurement variance corresponding to each sensor node be $\delta_1, \delta_2, \dots, \delta_n$. Data fusion of the measured teaching management information will obtain the latest observations as:

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$$Pj(x,y)=i=1nviPij(x,y) \tag{1}$$

The average formula for the information construction level of the integrated campus is:

$$Wi=1M \text{ is } \epsilon \text{ mi Pi} \tag{2}$$

Among them, L_i is the number of sub-regions containing sensor node i of the distributed teaching

management scheme; M_i is the set of all sub-regions containing distributed sensor node i [14].

Need to the introduction of teaching management systems and management documents in the new era. The scheme of this article includes user management, course management, application [15]. The instantaneous observation teaching transaction values of all neighbor nodes of each node k at time t are used to construct the instantaneous neighborhood observation value set of node k according to some arbitrary sequence, as follows:

$$yNk, t = y|kn, t \tag{3}$$

The scheme can handle complex teaching management business, and at the same time, the scheme also provides further analysis, sorting, and statistical functions for the teaching operation data, which can provide certain decision-making services for the macro management of schools.

2.3 Operating Environment and Security Architecture

The three-tier application software architecture that adopts the mixed structure of B/S and C/S is a cross-platform application. This application is very suitable for Intranet/Internet applications (As far as the two are concerned, the Internet is very large and the management is very complicated, while the Intranet is relatively small in scale and works well.). These determine that the operating environment of the software must be in an open network. In terms of operating environment, the operating system of this system uses the Windows 2000 series of user machines and server versions, and the security operation of the C/S part can be guaranteed through server settings, but the risk to the B/S part is still high [16]. Therefore, this paper redefines the security framework for the B/S structure as follows. The security platform of B/S (Browser/Server) architecture is realized based on TCP/IP protocol. It implements the Security Socket Layer (Security Socket Layer) in the application layer and the network layer, which is used to protect the security of the application layer (where students choose courses, teachers enter grades), and will focus on implementing the function of the Secure Socket Layer (SSL) based on the HTTP protocol. Among them, the HTTP (hypertext transfer protocol or Hyper Text Transfer Protocol) protocol level is for specific applications in which teachers enter grades, view course selection and course arrangement, and students select courses, query grades, and conduct teaching quality evaluation. Through the control of the SSL layer, the above operations do not directly act on the database server, but act on the secure application platform between them, which

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protects the communication between the two. The energy consumption of sensor nodes is an indicator performance that must be considered. When the energy consumption of nodes is reduced, the entire lifetime of the network will also be extended due to the increase of the remaining energy. The energy consumption of node i in the teaching supervision process can be expressed as [17]:

$$E_i = E_{send}^i + \sum_{e_{ij} \in Net} p_{ij}^{c_{ij}} t_{ij} \tag{4}$$

(1) Distributed data storage of teaching management information

The distributed storage of teaching management information is a way to store the sensory data generated by the node without using the node itself. During data access, an information intermediary can be established between the teaching management data storage and the teaching management data access, and the access requirements can be achieved through the access information intermediary. At the same time, in order to ensure the confidentiality of sensitive data in teaching management, the distributed network storage solution for teaching management can store the collected data in segments, and store different segments on different storage nodes. That is, a complete piece of teaching management data will not be stored on a storage node. In this storage mechanism, the teaching management data is first divided into segments, and then the data segments are stored on other nodes according to a specific storage method. In the data query request, the teaching management data is queried segment by segment through a specific query method [18].

When the radio interface m of node i sends data on the link, the signal-to-noise ratio (SINR) of the student information processed by the receiver j during teaching management can be expressed as:

$$\alpha_{im} = \frac{G p_{im} h_{im}^{c_{im}}}{\sum_{c_{im}=c_{jn}} p_{jn} h_{ij}} \tag{6}$$

(2) Distributed sensor query process

In the teaching management process, the storage node inside the sensor is equivalent to a local small node. Teacher can inject the query request of teaching management data into the sensor network through the proxy database server, and then query the local data of the sensor node, so as to obtain the query result of the teaching management data that the teacher is interested in. At the same time, for the query request, the teaching management data query: one is the stage where the query request is injected into the network, and the other is the stage where the network collects the feedback data and sends it to the teacher according to the query request. The process of query injection into teaching management distributed sensor network can be divided into four stages: first, the teacher submits the query request; then the query request is parsed in the network; after parsing, the query is optimized through the optimization mechanism; distributed to each node. When these four stages are completed, each sensor node gets the query request submitted by the teacher, which is ready for the second stage of teaching management data feedback and teaching management data collection.The query process is shown in Figure 2.
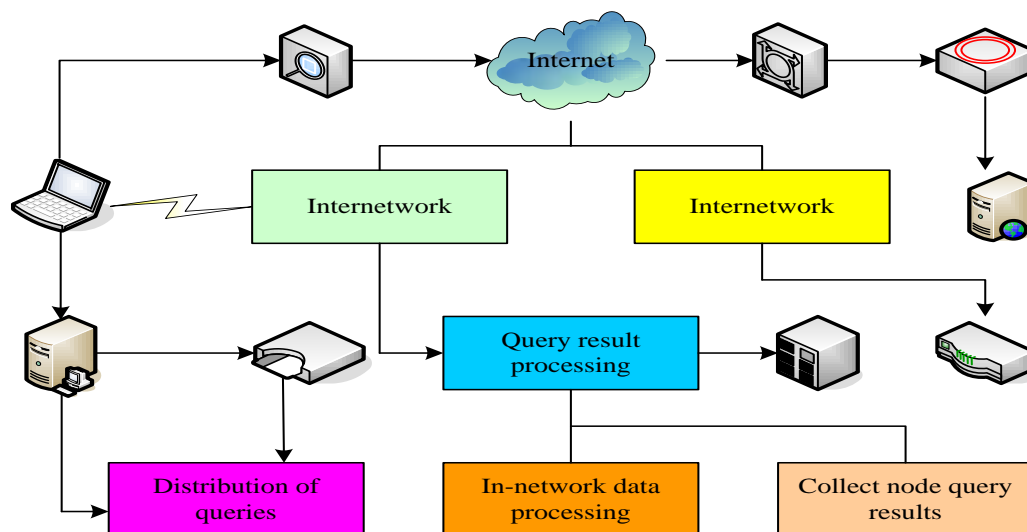
Figure 2. Query process

3.Effect of Teaching Management in Colleges

Modern information technology helps schools to formulate scientific teaching plans. Teaching objectives and plan is the schedule of school teaching development, also known as curriculum plan, which is the overall planning of school curriculum. However, more than 25% of teachers still don't know much about information-based instructional design. Using modern information technology and arranging teaching plans through the teaching plan management system can make it easier and more scientific for schools to arrange teaching plans, and also allow schools to arrange more elective courses for students to choose.
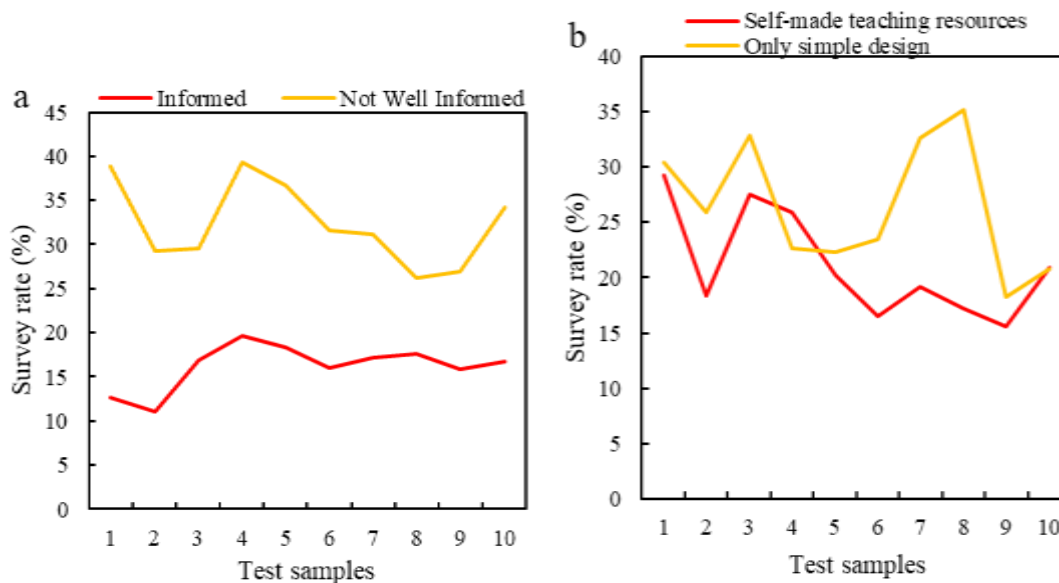

Figure 3. (a) Teachers' knowledge of the technolof (b) Teachers' DIY of teaching resource and simple designs

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Faculty and staff are the main body of teaching management informatization construction. However, due to the deep influence of traditional educational ideas and concepts, a small number of teaching staff cannot accept the new informatization concept in one step, and are still accustomed to the traditional teaching management mode and processing method. They are usually unwilling to use the system to complete the processing of teaching matters such as adjustment (stoping) courses, teaching venue reservation and other reasons for the reason that the system cannot be used, which affects the implementation effect of system use to a certain extent.Full-text database of China Journal Network (CNKI,is the largest full-text current journal database) was used to search related articles on teaching management. The detailed results are shown in Table 1.

Table 1. CNKI search results

Category	Subject heading	Title	Key words
Informatization Instructional Design	1523	70	600
College Information Teaching Design	233	6	18
University Informatization Teaching Design	188	4	20

Among the information-based teaching tools for college teachers, E-mail accounts for 40%, the use of search engines accounts for 20%, and the handouts on FTP account for 15%, as shown in Figure 4(a). 10% of BBS(Bulletin Board System) posts and discussions, 10% use communication software, 5% use blogs, and 24% never use them, as shown in Figure 4(b).

The foothold of modern educational technology is education rather than technology, but the reality is the opposite. Therefore, the current research on modern educational technology is mostly formalized and superficial, and often lacks in-depth study of modern educational theory, lack of attention to teachers' professional growth, and lack of connection with teaching practice. These are not desirable. It does not mean that the use of information technology is an efficient classroom. The rational combination of information technology and traditional technology can reflect the advantages of information technology in the teaching process. Teachers should not give up their the advantages as a direct and cordial educators. In the integration of school education information resources and the school's teaching management, a very important part is to manage and apply teaching resources. The school uses modern information technology to manage students in a diversified way.
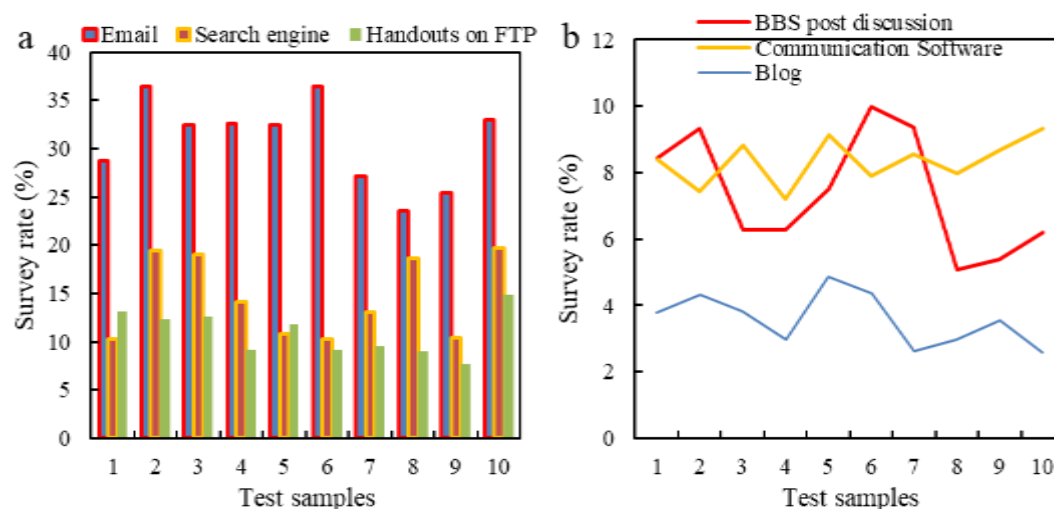
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Figure 4. (a) Email, search engine, and handouts are placed on FTP. (b) Post discussions on BBS, newsletter software and blogs

In this computer network environment, each management department only uploads part of the data of their stand-alone management software to the file server as a certain type of file for other departments to download and visit. Each department carries out data import and export according to a certain data format, which realizes some offline, non-real-time data sharing in form. However, because this sharing mode does not adopt the centralized storage, operation and management of a centralized database for each computer terminal to access, the access to teaching management information resources(include information, materials, equipment, personnel, and places) is not smooth. The stand-alone teaching management software of each department provides data format conversion services most of the time. In addition, because the shared data files are offline and non-real-time, the latest data actually managed by each department and the shared data that has been accessed by other departments are often inconsistent. In this case, information asymmetry is very easy to happen, and at the same time, various problems of single-computer management data in each department still exist.

Indexes with correlation coefficients less than 0.35 to other indicators (item to total) were deleted from the study. The survey shows that many colleges have used the 2-3 version of the information system), so this item been deleted. The correlation factor test results are shown in Table 2.

**Table 2. Test results of correlation factor**

Management elements	Index	Item to total	Alpha value after removing the fourth item
Informatization level	High degree of	0.445	0.663

of teaching management in colleges and universities	information system integration	
	In line with the actual school situation	0.332
	Academic project or scientific research achievements	0.556
	Less frequent replacement of information systems	0.116
	Work efficiency has been greatly improved	0.443

Among the teaching management personnel, more than 80% of the total number have a degree of master (the vice president and the teaching management personnel of the Academic Affairs Office are shown in Figure 5(a)). There are 63 people with 3-5 years of teaching management experience, 32 people with 6-10 years of experience, and 22 people with more than 10 years of experience. Among them, there are as many as 10 teaching management personnel with professional backgrounds in computer and computer-related majors in the Academic Affairs Office, accounting for about 50% of the total number of the Academic Affairs Office. Relying on data flow and work flow, several reorganizations and personnel redistribution are carried out to achieve organizational integration. The introduction of technical personnel provides organizational and technical support for informatization construction, effectively breaks through the technical bottleneck of the Academic Affairs Office under the traditional organizational situation. If it can be used well, teachers can better apply it to teaching, and each school should organize, plan, save, and then share it, so that everyone can learn and progress together. Teachers should use information technology to integrate subject resources, actively develop teaching courseware, record teaching resources videos, actively carry out teaching exploration and learning, and promote the improvement of their own teaching quality. Traditional teaching has its essence, which cannot be discarded. Teachers can integrate traditional teaching experience in lesson preparation, and prepare courseware suitable for each lesson.

The teaching management team of M University mainly includes the vice president, the teaching management staff of the Academic Affairs Office, the teaching dean in charge of the college, and the teaching secretary. The Academic Affairs Office of M University has formed a teaching management team adapted to the informatization of teaching management. Since the Academic Affairs Office of M University regards computer operation ability as an important indicator when selecting personnel, there are as many as 10 teaching management personnel with a computer professional background,

which is close to 50% of the total number of Academic Affairs Office (except for the textbook department). This kind of personnel structure will avoid many errors caused by computer database operation mistakes, and greatly improve the informationization effect. It can be seen that the Academic Affairs Office of M University attaches great importance to teachers' information literacy, and has carried out human resource management reasonably, which has promoted the improvement of the school's teaching management informatization level. There is a positive correlation between the levels of transformation, and the degree of influence is large.
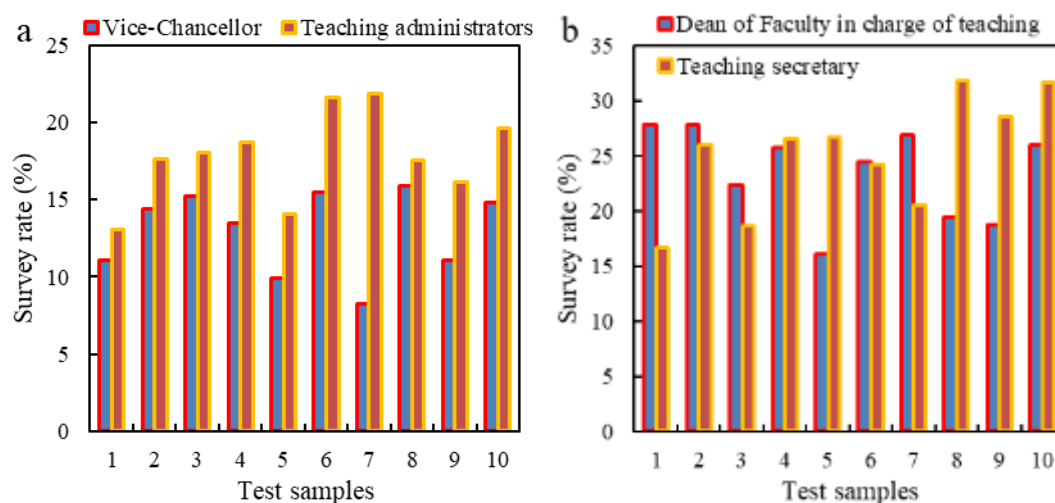
(a) Vice-principal, teaching management staff of the Academic Affairs Office. (b) Dean of teaching and the teaching secretary of the college.

Figure 5. Computer-related professional statistics.

The corresponding running time is shown in Figure 6. Testing and analyzing the network teaching management system of college departments. At the same time, it has network teaching management functions and client-side operation functions, which further shows that the network teaching management system is suitable for colleges. Business needs of information service and data analysis of the network teaching department have good practical application value. For students, because the school adopts the academic credit system for teaching, the compulsory courses of students are mainly arranged by the department, and the elective courses are the form of students' independent online course selection, as long as the students choose enough credits within the specified years.
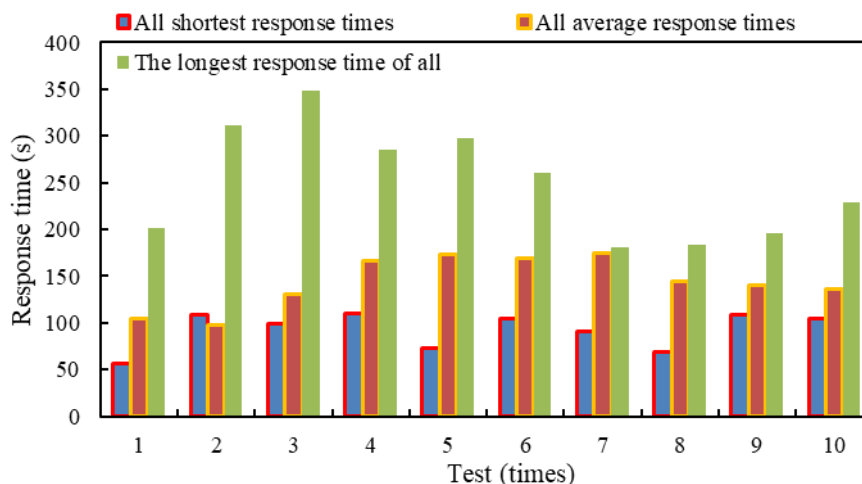
Figure 6. Corresponding running time

4.Conclusion

One of the key indicators of the success of the development of teaching management informatization in colleges and universities is the major role that it plays in the many initiatives related to school teaching management. College informatization emerged from the teaching management field, and the development and study of teaching management informatization is crucial to the establishment of the fundamental systems for school affairs. Based on the current state of college teaching management informatization popularisation, this study analyses and summarises the causes and issues related to college teaching management informatization as well as summarises and simplifies workable solutions to enhance the informatization of college teaching management. In order to highlight the information service as the research carrier and increase teaching management's efficiency, this article suggests applying distributed sensor networks to the system's information processing. The study's limited sample size, however, means that future research must examine the issues surrounding the administration of school instruction and the methods used to address them in a more thorough and methodical manner.

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