Few-Shot Learning-Driven Optimal Allocation Model of University Human Resources Based on the Apriori Algorithm

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For universities, HR is the first element and the first resource to build university resources. Systematic construction and management of HR and effective development and utilization are the key factors to promote the development of universities. In this paper, the Apriori correlation rule mining algorithm is studied, the optimal allocation model of university HR based on the Apriori algorithm is studied, and the strategy of optimal allocation of university HR is discussed. DM can discover the talent patterns and laws within the organization, so as to find the talent model within the organization. The results show that the method proposed in this paper can be used to mine the correlation rules of the university HR data set, and good results can be achieved. The system can realize the standardization, safety, and paperless work of university personnel, which has changed the original manual work mode and greatly improved the work efficiency. The method in this paper can be used to determine a reasonable HR structure according to the development goals and plans of our school, establish a scientific talent evaluation mechanism, clarify the age structure of teachers, provide an important scientific method, and provide objective decision support for formulating talent demand planning, talent recruitment, and training.

1. Introduction

Today’s society is in the information age, and information has emerged as one of the society’s three primary resources. We are surrounded by a vast amount of data and information [1]. Higher education has begun to gain popularity around the world, and demand for higher education has risen dramatically. In this context, most countries see increased education investment and improved resource allocation efficiency as critical to the development of higher education and the promotion of national economic growth [2]. Without exception, China has joined this group. The rapid development of higher education in China, as well as the rapid expansion of enrollment, has put a strain on university resources [3]. Human resource (HR) management and how to make flexible and reasonable educational administration arrangements are becoming increasingly important in this context. Globalization of the economy and the knowledge economy have gradually become the times’ hallmarks. In China, the contradiction of education is most visible in the growing gap between rising demand and limited resource supply [4]. Due to the rapid development of database technology and the wide application of a database management system, people accumulate more and more data. There are many important information hidden behind the surge of data. People hope to analyze it at a higher level in order to make better use of these data [5]. It is an inevitable trend for the development of social informatization for university management decision-makers to understand and master the teaching operation of the whole university and make various decision-making arrangements through modern informatization tools [6].

Systematic construction and management of HR and effective development and utilization are the key factors to promote the development of universities [7]. How to seek survival and development in this talent competition is more important and urgent for university HR management [8]. How to effectively use HR, improve the efficiency of HR utilization, and improve the efficiency of universities or departments is a problem of great concern to managers [9]. On the whole, the resource allocation of higher education can be divided into three aspects, including the allocation of HR,
material resources, and financial resources. Under the influence of various reasons [10], China has many problems in the allocation of higher education resources, especially in the allocation of HR in public universities, and the economic and social benefits of higher education have been greatly affected [11, 12]. Correlation rule mining in data mining (DM) technology is to automatically mine many associated rules from a lot of real data by using a computer [13]. The Apriori algorithm in correlation rule mining technology is to find out the relationship between itemsets in the database and form rules by means of an iterative method of layer by layer search [14]. This paper studies the Apriori correlation rule mining algorithm, studies the optimal allocation model of university HR based on the Apriori algorithm, and discusses the strategy of optimal allocation of university HR.

Entering the era of knowledge economy, with the progress of science and technology and social development, the competition for talents is becoming increasingly fierce. The quantity and quality of high-quality talent resources have become an important indicator to measure a country’s comprehensive national strength [15]. The research on the optimal allocation of HR in universities is related to the construction level of high-quality teaching and scientific research talents in the future. It is an extremely important research topic faced by universities [16]. Therefore, mastering and analyzing advanced decision-making technology, decision-making system, management methods and HR information, and excavating the value of talents are an important work link to achieve the development goal of the university [17]. DM can discover the talent patterns and laws within the organization, so as to find the talent model within the organization. By taking the university HR database as the research object, studying DM methods and extracting valuable information can provide a scientific basis for decision-makers [18]. Using this method, we can determine a reasonable HR structure, establish a scientific talent evaluation mechanism, clarify the age structure of teachers, provide important scientific methods, and provide more objective decision support for talent demand planning, talent recruitment, and training. The system can realize the standardization, security, and paperless work of university personnel, change the original manual work mode, and greatly improve the work efficiency.

2. Related Works

The optimal allocation of university HR is an important part of university resource allocation and the core issue of university HR management. With the development and improvement of computer technology and its network, it has become a historical necessity to drive education modernization with educational informatization, and the focus of university informatization construction has shifted from individual universities to national universities. Campus network construction has sprung up as the times require. Anselmsson et al. believe that the optimal allocation of HR in universities emphasizes that the overall planning, organization, and control of HR can keep the best proportion of HR at all levels and positions, so that people’s potential can be brought into full play and their creativity can be greatly displayed [19]. The average experience, energy, system coupling, and structural characteristics of HR management were studied in the literature [20], and the mathematical analysis theory of HR management was established. Literature [21] examined some performance and other related factors and proposed the incentive mechanism framework theory based on Porter Lawler’s comprehensive incentive theory model. According to Kiwanuka and others, higher education is characterized by complexity, which explains why people’s preferences for educational outcomes are so diverse [22]. Literature [23] points out that the most important thing in modern organization’s HR management and the most critical problem in organization development are to give full play to the potential of HR and maximize the utility of HR in the organization. Literature [24] points out that university leaders’ emphasis on teachers’ resources, their deep understanding of HR, and the implementation of the measures they take determine the quality of university HR allocation. With the vigorous development of university informatization and management software, the HR management information system for HR management has become an important tool for universities to absorb, retain, and motivate HR, integrate other resources in universities, and gain competitive advantages. It is of great practical significance to study DM methods, extract valuable information, determine a reasonable HR structure according to the development goals of universities, and determine the talent introduction and training goals.

3. Materials and Methods

3.1. Fundamentals of DM. A comprehensive diachronic and synchronic analysis of the current situation of HR in Chinese universities and an assessment of the quality of university personnel are the premise and basis for further optimizing the allocation of HR in universities. With the development of computer technology, the database has evolved from the early file processing to a more powerful database system and further evolved into the commonly used relational database system at present. Users can easily access the database through structured query language. DM is to find the rules from massive data by analyzing each original data, which mainly includes three steps: data preparation, rule finding, and rule representation [25]. User interface, pattern evaluation, mining engine, data warehouse server, and data source are all common components of a DM system. Many universities have established increasingly perfect personnel information management systems and accumulated a large amount of complete data as computer technology has advanced. Currently, the primary purpose of these data is to provide management departments at all levels with various statistical reports and information inquiries. To realize the university’s development, university HR managers must have a set of decision-making systems that are beneficial to HR management, assist the university in the management and development of strategic HR, and serve
the university’s strategic and tactical goals through excellent HR, teams, and organizational structures.

The user’s knowledge discovery request is interpreted and converted into a specific mode through the user interface, submitted to the DM engine, and the cleaned data set is mined through the database or data warehouse server. The patterns discovered in the mining stage need further analysis and evaluation. If there are redundant or irrelevant patterns, they need to be deleted to generate practical knowledge, and the knowledge base is revised by users, and the DM engine is correspondingly updated with the update of the knowledge base. Before DM, first of all, it is necessary to make clear what kind of problems are solved and what purpose is achieved by DM. According to the requirements of users, it is necessary to determine the types of knowledge to be discovered by DM and establish clear objectives. HR refers to a group that can promote the whole social and economic development within a certain range, has the ability of intelligence and physical labor, and can exert creative labor on the basis of labor resources [26]. As a special organization, the university undertakes the training of talents from all walks of life in the country, and these talents create great economic value for the country and society. In DM, correlation rule is one of the main technologies, which reflects the correlation and dependence between one event and other events, and it is also the most common form of mining local patterns in an unsupervised learning system. If there is a correlation between two or more things, then other related things can be used to predict the occurrence of something. The University HR DM process is shown in Figure 1.

Data preparation is complicated, but it is very important. The quality of data preparation will affect the efficiency, accuracy, and effectiveness of the final pattern of DM. University HR is a collection, and the object of the collection is all the faculty and staff of the school. In the collection, although there are differences in the job functions of different roles, they all revolve around a basic point, that is, to ensure the normal operation of the organization. Their work functions include teaching, scientific research, management, and service. In order to realize the smooth connection among the functional departments of the university, improve the overall work efficiency, and increase the benefits, it is necessary to plan the HR of the university effectively. According to the time series and known changes, statistics and other methods are used to fill in the lost data [27]. The pattern models obtained from DM need to be evaluated, and redundant or irrelevant patterns are eliminated by machine evaluation to determine which patterns are effective and useful. If the patterns are not satisfied, they will be returned to the previous processing steps and extracted repeatedly. Evaluation can be based on user experience or directly verify its accuracy with data. Finally, the verified pattern model is expressed to users in a way that users can understand.

3.2. Optimal Allocation of University HR Based on the Apriori Algorithm. HR refers to the sum of intelligence and physical labor ability that can promote the whole social and economic development within a certain range, and it is a group that can exert creative labor on the basis of labor resources. In order to achieve the expected goal, it is not a simple process to mine hidden information from a large amount of data and apply DM technology reasonably. The following is the basic idea of the Apriori algorithm: firstly, frequent itemsets are mined from the object database. Compared with the minimum support threshold, all itemsets with support greater than this threshold belong to frequent itemsets. Then, the generation of correlation rules is based on frequent itemsets. The purpose of optimal allocation of university HR is to focus on the goal of running a university, make these HR effectively combined in time and space, combine them with other resources, improve the utilization efficiency of university HR, improve the efficiency of running a university, and realize the goal of optimal allocation of university HR. The user information management module sets different user roles according to different permissions, including system administrator and ordinary users. Users with different roles have different permissions after logging in to the system. The system administrator has the highest authority in the system and can add, delete, and check all modules. Ordinary users can assign the management authority of some modules and the management authority of personal information. They can only manage the business they are responsible for and maintain personal information. The application structure design of the Apriori algorithm in the optimal allocation of HR is shown in Figure 2.

The amount of data is unknown, irregular, and massive, and its characteristics and forms are also very different. The requirement of data form also increases the difficulty of
successful application of DM technology. Therefore, it is a very important task to reasonably choose the DM mode. In the design of the HR management system, all information related to HR management is analyzed and abstracted to form a logical model, which is stored in the database for centralized management. The HR information database can efficiently index, query, and summarize all of the data in the HR management system and reflect the data’s content and relationships. In general, university HR functions are similar to those of university teachers. Teachers’ human resources are the most valuable resources in all schools, as well as the main body of the school, regardless of whether they are in universities or other levels of education. The government controls and dominates the decision-making power over university HR allocation in the planned economy era. The university’s personnel autonomy has changed as a result of...
the establishment of the market economy system and the continuous development and deepening of China’s higher education system reform, and the university’s HR allocation right has been continuously expanded and strengthened.

Assuming that a department has $n$ majors at time $t$, the number of students in each major is $k_1(t), \ldots, k_n(t)$, and the teacher-student ratio of the $i$th major is $R_i (0 < R_i < 1)$, then the basic teaching staff of the $i$ major is

$$u_i(t) = k_i(t) \times R_i.$$  \hfill (1)

In order to better describe the characteristics of each major, that is, different majors have different development potentials and personalities. Define the $i$-th professional development potential as $P_i(t)$. On the premise of fusing implicit features, equation (2) can obviously be extended to

$$u_i(t) = k_i(t) \times R_i \times P_i(t).$$  \hfill (2)

Considering the situation of retirement, transfer, etc., until time $t$, the estimated number of lost teachers among the existing teachers is counted as $r_i(t)$; then, at time point $t$, the number of teachers needed for the $(i = 1, \ldots, n)$ major is

$$u_i(t) = k_i(t) \times R_i \times P_i(t) + r_i(t).$$  \hfill (3)
The total number of teachers $U(t)$ actually needed by the department and the number of teachers needed by each major $u_1(t), u_2(t), \ldots, u_n(t)$ satisfy

$$ U(t) = \sum_{i=1}^{n} u_i(t), $$

$$ u_i(t) = k_i(t) \times R_i \times P_i(t) + r_i(t), $$

$$ \ldots $$

$$ u_n(t) = k_n(t) \times R_n \times P_n(t) + r_n(t). $$

Let $w_i = w_i(t) = k_i(t) \times R_i (i = 1, \ldots, n)$; then, $U(t)$ is expressed in the matrix form as

$$ U(t) = (w_1(t), w_2(t), \ldots, w_n(t)) \left( \begin{array}{c} P_1(t) \\ P_2(t) \\ \vdots \\ P_n(t) \end{array} \right) + (1, 2 \ldots, n) \left( \begin{array}{c} r_1(t) \\ r_2(t) \\ \vdots \\ r_n(t) \end{array} \right). $$

(4)

In view of a large amount of transaction data, the transactions are traversed one by one from a single item and compared with the minimum support threshold preset.
by the user; if the support is less than this threshold, this item will be deleted and then extended to all transactions, and the frequent itemset is the set of items finally preserved. Data correlation is an important type of information found in databases. It is said that there is a correlation between two or more variables if there is some regularity between their values. Simple correlation, time series correlation, and causal correlation are the three types of correlation. The goal of correlation analysis is to uncover the database’s hidden correlation network. The subset generation method is used to generate correlation rules. If the confidence is lower than the preset minimum confidence threshold, this correlation rule will be deleted, and the remaining correlation rule will finally meet the needs of users. In any organization, the principle of HR allocation is to reduce HR costs, improve HR utilization efficiency, and generate the greatest economic and social benefits. To allocate and optimize HR, a state-owned university can learn from the experience and mode of HR allocation of for-profit organizations such as universities and companies. You may not be aware of the correlation function of data stored in the database, or you may be aware of it but it is uncertain. Therefore, an important attribute of rules generated by correlation analysis is the credibility of rules.

The task of correlation rule mining is to find interesting correlations or related relationships between itemsets in a large amount of data. Mining frequent itemsets is the first step and the most critical step of the correlation mining algorithm. Starting from a single item and gradually reducing it are the most remarkable features of the Apriori algorithm, and the search process of the item has been greatly simplified. Finding frequent sets is not a simple process. First of all, there are a large number of customer books, sometimes larger than the memory of the computer, beyond the storage range of the computer. The inputs needed to generate correlation rules are frequent itemsets mined earlier and confidence. According to the formula,

$$\text{confidence}(X \Rightarrow Y) = \frac{\text{sup port}(X \cup Y)}{\text{sup port}(X)} \times 100\% = P(Y|X),$$

where \(\text{sup port}(X \cup Y)\) is the number of transactions containing the itemset sum and \(\text{sup port}(X)\) is the number of transactions containing the itemset \(X\). From this, the algorithm description for generating correlation rules can be obtained.

With the development of society and the progress of science and technology, the cost of HR allocation pursued by for-profit organizations will be continuously reduced. However, it is impossible for universities to pursue cost reduction blindly, because universities are committed to cultivating qualified talents and promoting the vigorous development of education by improving teaching quality. Whatever correlation rules are used, they all show a relationship between data. To put it another way, it is some kind of correlation between attributes, and it can also be thought of as a correlation between two businesses. However, no matter how abstract, a correlation rule mining algorithm lacks human wisdom, and the end result is that data is used to reflect some kind of connection. The degree of support can be used to determine the importance and frequency of correlation rules. The higher the level of support, the bigger the role and influence it has in all transactions. Correlation rules become more important as the amount of support grows.

Some correlation rules have low support and high confidence, indicating that, despite their accuracy and strength, they are rarely used in practice. It is critical to emphasize...
that the setting of posts is the foundation for university HR allocation. That is to say, in the university development strategy and HR planning, scientifically and clearly define the types and quantity of posts to ensure that the posts set are necessary for the development of the university.

4. Result Analysis and Discussion

The composition of a system or model is made up of a number of variable factors that influence each other. Some of these variables are juxtaposed with each other, and others are the relationship between influence and influence. According to their initiative, we divide them into independent variables and dependent variables. The competition in today’s society is mainly the competition of HR. With the success of reform and opening up and the deepening of higher education reform, the scale of universities is getting larger and larger. For the evaluation of model colleges, the level of teachers is constantly improving, and the scale of teachers is also constantly increasing, which makes great changes in the management methods and contents of universities, and the traditional manual management urgently needs to change to information management.

When we analyze a certain system or model, we observe the relationship between its variable factors. If the change of some variables leads to the change of others, then we call the former independent variable and the latter dependent variable. On the basis of the existing university HR, combined with the number of students in each major of the school, according to this standard, the number of teachers at all levels suitable for the development of this major is optimized, and the number of talents with different titles and levels is introduced, so as to improve the teaching and scientific research ability of the school, improve the comprehensive ability of the school, and enhance the competitiveness of the school. The optimal allocation of HR realized by the Apriori algorithm can access as few communities as possible through a shorter path and get the HR you are looking for quickly. The comparison of the number of communities involved in the algorithm is shown in Figure 3.

The development of university is based on a certain team of teachers, management team, teaching assistants, and social service personnel. One of the main factors that determine and restrict the efficiency of school management is the large number of university faculty. The number and scale of university staff must form a joint force ratio with the number of certain university students. If the number of university faculty exceeds the number needed for optimal tutoring of university students, it will result in waste of staff, which will lead to low scale benefit of running a school. The HR search system implemented by the Apriori algorithm and literature [23] algorithm involves the comparative analysis of paths, which are represented by edges in Figure 4.

In order to achieve the best allocation state, we should not only include the independent variables of allocation in the process of building the university HR allocation model but also consider the changes of dependent variables and adjust the allocation by observing the influence degree of the changes of independent variables on dependent variables. The process of transforming university scientific and technological achievements is a complex one. When we look at the composition of its influencing factors, we can see that government departments, universities, production universities, and technology markets are all heavily influenced. The university is the birthplace of scientific and technological achievements, as well as the foundation and starting point for the ultimate transformation, in this system of multiple influencing factors. The comparison of the search success rate between the Apriori algorithm and the algorithm in Reference [23] is shown in Figure 5.

University personnel management is a time-consuming and difficult task, and using information system management to improve work efficiency can be extremely beneficial. Traditional personnel management systems, on the other hand, lack data analysis and trend prediction capabilities, making it impossible for decision-makers to have accurate data on which to base their decisions. Government departments can make macrocontrol on suppliers, demanders, and intermediaries of scientific and technological achievements as part of a control system for the transformation of scientific and technological achievements by formulating corresponding promotion plans, policies, and regulations and establishing corresponding institutions.

For universities, HR is the first element and resource to build university resources and the key factor to promote the development of universities. How to seek survival and development in this talent competition is more important and urgent for university HR management. At present, the main functions of the HR management system are reports, statistics, and information inquiry, and it can also efficiently and quickly realize the functions of adding, deleting, and checking data, thus improving the work efficiency of personnel management. In order to verify the effectiveness of the Apriori algorithm in improving the optimal allocation of HR, a comparison is made before and after the Apriori algorithm is introduced, and the experimental results are shown in Figure 6.

The experimental results show that the optimal allocation of HR with the Apriori algorithm is higher than that before the recommendation recall. The Apriori algorithm with implicit features proposed in this paper is designed to replace the explicit features of user-positions by designing the user-position fusion features as the initial input of the Apriori algorithm model. In order to test whether the fused features can improve the model performance, the Apriori algorithm input is compared before and after the implicit features are introduced, and the experimental results are shown in Figure 7.

The recommendation recall rate of the Apriori algorithm with implicit features is higher than that of the model based on explicit features, which proves that the introduction of implicit features of user-position enhances the feature information contained in the model input, thus improving the recommendation performance of the algorithm model. In order to test whether the performance of the mixed HR optimization allocation algorithm is better than that of a single algorithm, the performance of the three algorithms is compared here, and the experimental results are shown in Figure 8.
The reasonable scale includes the number of employees, the number of students, the number of graduates, and the matching number of faculty and staff. These indicators can well reflect the management quality and efficiency level of the university. In terms of university scale variables, we should emphasize the proportion of teachers and researchers and keep in mind that graduate students are the primary source of scientific research at universities. The university has a strong faculty and a leading research team, and it should be a major center for scientific research accomplishments in China. On the one hand, the transformation of scientific research results reflects Chinese universities’ research strength as well as their development focus. It does, however, reflect the university’s research level. Only after the transformation can the scientific research achievements exert their value, and only the scientific research achievements with high level and social demand can be transformed.

5. Conclusions

In today’s world, society and individuals are increasingly demanding education, but the human, material, and financial resources available for developing education are very limited. How to make good use of existing resources and obtain high-quality resources to vigorously develop education and science and technology has become a major problem that all countries in the world are thinking about and trying to solve in the stage of popularization of higher education and the period of global competition. The full text begins with the discussion of correlation rules of DM, until the in-depth introduction of the correlation rule mining algorithm Apriori algorithm. Finally, the correlation rules of the university HR data set are mined by realizing the Apriori algorithm, and certain results have been achieved. This paper studies the recommendation algorithm of HR and puts forward an optimal allocation model of university HR based on the Apriori algorithm from the perspectives of user interest and job matching. User information, job information, and historical behavior data were collected from the HR employment platform, and a series of data preprocessing operations such as data cleaning, conversion, and regulation were carried out according to the problems existing in the original data. Correlation rule mining can find out some connections between two things that do not seem to be necessarily related. Some of these connections are useful and valuable, and some of them are valuable and not desirable. In this paper, the Apriori algorithm is applied to the optimal allocation of university HR, and good results are obtained. However, due to the limitation of experimental conditions, it cannot be used on a large scale, so the follow-up work is still very complicated, and it is hoped that it can be programmed and commercialized in the future and can be used on a large scale for the analysis of HR data in schools.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The author does not have any possible conflicts of interest.

References


