Construction of University Human Resources Model Based on Big Data Information Security Technology

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Abstract.

In order to improve the innovation effect of human resources management of university teachers, this paper has developed a university human resource management software. Through the application of the system, the automation, systematization and standardization of management can finally be realized, which reduces the cost of manual management and the probability of errors, enhances the accuracy, practicability, and efficiency, so that the teacher's human resources can be used to the best economic benefits. In addition, this paper combines big data technology to analyze the status quo of human resource management of university teachers, and builds an intelligent analysis model with the support of big data technology to analyze the problems existing in traditional human resource management of university teacher. Through experimental research, it can be seen that the innovative model of human resources management of university teachers based on intelligent big data technology constructed in this paper can effectively enhance the innovation effect of human resources management of university teachers, and provide theoretical references for subsequent human resources management of university teachers.

Keywords: Big data; university teachers; human resources; management innovation; Information Security

1.INTRODUCTION

As the primary resource in the educational resources of universities, the importance of human resources in universities is self-evident. The management of human resources in universities is directly related to the reform of the personnel system in universities and the improvement of education quality. In the current human resource management in universities, there are some drawbacks [1]. The current human resource management methods implemented by universities are not conducive to the exertion of the subjective initiative of college teachers. The distribution system is relatively single, and the enthusiasm of teachers cannot be fully mobilized. With the development of the times and the gradual advancement of social transformation, it is necessary to improve the incentive mechanism in the management of human resources in universities, with rewards and punishments, forming a virtuous circle. Moreover, the establishment of an effective human resource incentive mechanism can ensure the normal, orderly and efficient operation of universities [2]. Incentive mechanism is the driving force of the internal operating mechanism of colleges and universities, and it plays a key role in improving the teaching quality and scientific research results of colleges and universities [3].

This paper combines big data technology to analyze the status quo of human resource management of university teachers, and builds an intelligent analysis model with the support of big data technology. Moreover, this paper analyzes the problems existing in the traditional human resource management of university teachers, and provides a theoretical reference for subsequent human resource management of universities.

In a general sense, the human resource management of college teachers means that colleges and universities continue to absorb teachers with high levels of knowledge, apply their abilities to the work of colleges and universities, and explore the potential of teachers, so as to stimulate the enthusiasm and enthusiasm of college teachers. Creativity and initiative will ultimately achieve all the development goals of universities. The human resource management of university teachers mainly studies the unique objective laws and internal connections of university faculty and staff in the management process. It also contains the following two points: First, the objects of university human resource management are unique. The objects of human resource management in universities are the teachers and researchers who participate in the process of teaching and scientific research, as well as the relationship between people and the environment in the process. The human resources of teachers in colleges and universities have been continuously improved in the development and continuously enriched in the use. This kind of perfection and enrichment, firstly, promoted the progress and improvement of human resource management science, and played a certain role in promoting the development and progress of human resource management in other fields. The second is that the human resource management of university teachers has a unique objective development law. The theories, methods, purposes and means of human resource management for university teachers are all developed with the progress of society. The human resource management of university teachers is the most important part of the educational resources of universities. Doing a good job in the management of university human resources is a prerequisite for continuously deepening the personnel system of universities and the key to improving the quality of teaching, scientific research and optimizing the faculty. Effective and active incentives for teachers and outstanding scientific research talents have become an important research content in human resource management in colleges and universities.

2.RELATED WORK

The literature [4] divided the factors that affect the incentive mechanism of college teachers into several categories, namely, career attractiveness, which refers to the attractiveness of the work content and sense of job accomplishment, and career stability, which refers to whether college teachers can work stably until retirement and get a good life guarantee after retirement. The literature [5] summarized some effective motivating factors for college teachers after conducting on-the-spot investigations on college teachers. They are the attractiveness of the position to teachers, good working environment, working conditions, and high social status. Therefore, the incentive measures they propose cover work tasks, reward systems, and personal growth of teachers. The literature [6] studied the non-salary incentive factors of teacher motivation, and divides the motivation of college teachers into internal and external factors. The literature [7] summarized the survey data of schools and faculty over the years, and based on this, established a database for relevant analysis of college teachers' motivation. Compared with the salary of university teachers, the excellent characteristics of the school itself can attract excellent teachers, especially young teachers [8].

Foreign scholars mostly conduct research on the material and spiritual needs of college teachers. Due to the strict recruitment system and high-standard requirements of college teachers, as well as the good social welfare benefits of western developed countries, college teachers can obtain generous salaries and corresponding social status and prestige at the same time. These all inspire the exertion of the subjective initiative of college teachers [9]. In different countries and regions, under different cultural and economic conditions, the research results of some developed countries are limited [10].

The literature [11] pointed out that since modern educational organizations are loosely connected organic organizations, we cannot use a standardized rigid management to manage them, but a flexible management with a higher level of rationality. At the same time, it is necessary to weaken the rigid components of the original rigid functions, change individual decision-making into joint decision-making, adopt fuzzy evaluation methods for school teaching management, use multiple incentive mechanisms, and carry out parallel communication to improve the efficiency of educational organizations.

The literature [12] analyzed the characteristics of knowledge-based employees, and concluded that the flexible management method based on respect for individuals is more suitable for the management of knowledge-based employees. Moreover, it further proposed the design of several aspects of flexible working hours, incentive schemes, and remuneration systems.

Developed countries have a relatively complete market economy, so compared with our country in terms of national conditions, there are many differences [13]. The main characteristics of the human resource management system for college teachers in developed countries are as follows. First of all, they implement a full-appointment system of human resources selection mechanism, and the school hires teachers in strict accordance with the needs of discipline construction, teaching and research and the positions set up in setting up jobs. Moreover, they achieve the unity and combination of job and professional appointment, the consistency of professional and technical positions and job positions, and the equal status of both parties when signing the appointment contract [14]. Secondly, under the conditions of a comprehensive market economy, they carry out the construction and management of the teaching staff of institutions of higher learning. Finally, for developed countries, the human resource management mechanism established on the basis of market mechanism orientation can form a relatively complete human resource flow mechanism [15]. Literature [16] pointed out that in a highly turbulent environment, if an enterprise wants to realize the coordination of employee capabilities with the changing competitive situation, scientific flexible management is very necessary, which can greatly improve the efficiency of organizational management. This is a brand-new concept of talent flow that people have formed in the face of global talent shortages. The “flexible flow” of human resources is different from the “rigid flow” that has many restrictions in the past in the flow of personnel. The literature [17] believed that to meet the specific needs of individuals, incentives and methods must be adopted, so that a higher level of effort can be used to achieve the management goals of the organization.

3.INTELLIGENT BIG DATA PROCESSING ALGORITHM FOR HUMAN RESOURCES IN UNIVERSITIES

BloomFilter was proposed by Burton Howard Bloom in 1970. Its space efficiency is very high. Bloom Filter is a kind of parameter storage through the mapping of multiple hash functions. Data structure for space compression. Bloom Filter is essentially composed of a relatively long binary bit vector and a set of Hash mapping functions. During the execution, through the mapping of the Hash function in the Bloom filter, a relatively large set of elements with a large number of elements can be collected. Mapping to a relatively small bit vector, the mapping result obtained by mapping the data element through the Hash function is called a hash value or a hash value. If you need to determine whether an element already exists in a set, you only need to map the element to be queried through the same Hash function, and then perform the hash value after processing with the value at the corresponding position in the Bloom filter Compare, if the corresponding bit vector values are all 1, it means that the query element already exists in the set, if the value is not all 1, it means that the element does not exist in the set, then the data should be put into the set to be operated. Since the Bloom filter algorithm does not need to store the element itself, it saves a lot of space, so it has a great advantage in data duplication. Its query efficiency and space efficiency are higher than other algorithms. It uses bit vectors A set is expressed concisely, and it can be judged whether an element belongs to the set without traversing one by one.

However, the Bloom filter also has some shortcomings. When judging whether an element belongs to a set, because the bit vector has been set multiple times before, it may be misjudged that elements that do not originally belong to this set are yes. Those belonging to this set are called false positives. It can be seen from this that the Bloom filter actually obtains higher space efficiency and time efficiency by sacrificing a certain accuracy. Due to the above reasons, BloomFilter is not suitable for situations that require relatively high data integrity. Suitable for use in applications where a small error rate can be accepted, the Bloom filter saves a lot of storage space by sacrificing few errors. Bloom Filter is also often used in web crawler systems to implement deduplication operations on URLs.

As mentioned earlier, the Bloom filter is essentially composed of a bit vector and a set of Hash functions. We assume that the size of the bit vector of the Bloom filter is m, and the value of each bit is 0 in the initial state, as shown in Figure 1[18].

Figure 1 Bloom filter vector initialization

k is used to represent the number of mapping functions in the Bloom Filter, and h() is used to represent the hash function. We assume that the set to be eliminated is $S=\{x_1,x_2,x_3,\dots,x_n\}$, and there are n elements in the set. Bloom Filter maps each element in the set to the corresponding position of the bit vector of the Bloom filter through k Hash functions. For each element x in the set, through k Hash mappings, the 0 of the corresponding position $h_i(x)$ of the mapping is set to 1 (1<=i<=k). If the value of the bit is found to be 1 when it is set, no more setting operation is performed, and the value of the bit is kept at 1. Figure 2 below shows the mapping setting process of the three Hash functions, we set k=3[19].

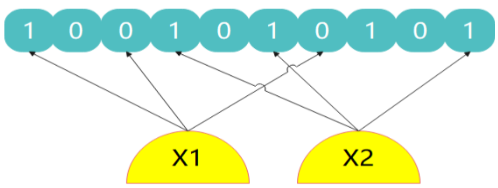

Figure 2 Bloom filter storage mapping process

For the element x_1 in Figure 2 above, the values corresponding to positions 1, 3, and 7 are set to 1 through three Hash functions. After the next element x_2 is mapped, it is found that the value of position 3 that needs to be set to 1 is already 1, so the setting operation is no longer performed, and the operation of the next element is performed according to the result of the first setting.

When judging whether the element y belongs to the set, the mapping is performed through the same Hash function, and the judgment is made according to the value at the corresponding position, as shown in Figure 3 below.

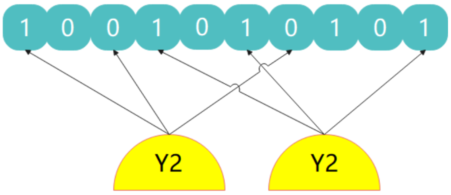

Figure 3 Bloom filter storage mapping process

In Figure 3 above, the value of position 0 in the positions 0, 2, and 6 that y_1 maps to is 1, and the value of position 2, 6 is zero, so y_1 is not considered to belong to this set. The values of the corresponding positions 3, 5, and 9 to which y_2 is mapped are all 1, so the element y_2 is considered to exist in the set. In fact, it may only be that the corresponding position after y_2 mapping has just been set to 1 during the previous mapping operations of multiple elements, and y_2 may not belong to the set, which leads to a misjudgment. The element y_2 that does not belong to the set is mistaken as belonging to the set.

The size of the bit vector of the Bloom filter is m, and the initial values are all set to 0. The number of hash functions in the Bloom filter is k, and the number of elements to be operated is n. Since each element corresponds to k bits on the bit vector after Hash mapping, there is $k_n < m$.

When the first element passes through the first Hash mapping, the probability that a bit in the m-bit bit vector is still 0 is[20],

$$1-\frac{1}{m} \quad (1)$$

There are a total of n elements in the set to be operated, and each element requires k Hash operations. When all the n elements are Hash-mapped, the probability p that a certain bit is still 0 is,

$$p=\left(1-\frac{1}{m}\right)^{kn}=\left(1-\frac{1}{m}\right)^{mkn/m} \quad (2)$$

From the formula of natural logarithm e, we can get

$$\lim_{x\to\infty}\left(1-\frac{1}{x}\right)^{-x}=e \quad (3)$$

We can get

$$p \approx e^{-kn/m} \quad (4)$$

On the basis that n elements have been hashed, when a new element y comes, if the position of the element corresponding to the bit vector has been set to 1 after performing k Hash operations, the element y will be considered to already exist in the set. In this case, a misjudgment has occurred. We use f to represent the rate of misjudgment, combined with the above formula, then there is

$$f=(1-p)^{k} \approx \left(1-e^{-kn/m}\right)^{k} \quad (5)$$

$$f = e^{\left(k\ln^{\left(1-e^{-kn/m}\right)}\right)} \quad (6)$$

From the above formula analysis, it can be known that the value of the false positive rate f is directly related to the number of set elements n, the size of the Bloom filter bit vector m, and the value of the number of hash functions k. Moreover, the misjudgment rate will increase as the number of collection elements n increases. If f is to be kept constant, the size of the Bloom filter bit vector m should keep increasing simultaneously with the number of collection elements n[21].

In order to maintain the minimum false positive rate, we first discuss the number of hash functions k in the Bloom filter. It can be seen from the above formula that if we want to keep the false positive rate f to a minimum, the value of k is not as large as possible or as small as possible. We first assume that the size m of the Bloom filter bit vector and the number of elements n in the set have been determined. In order to facilitate the following discussion, for the above formula, we set

$$g = k\ln^{\left(1-e^{-kn/m}\right)} \quad (7)$$

As long as g takes the minimum value, the value of f is the minimum. From the above formula $p = e^{-kn/m}$ can be obtained

$$k \approx -\frac{m}{n}\ln(p) \quad (8)$$

Then, g can be expressed as

$$g \approx -\frac{m}{n}\ln(p)\ln(1-p) \quad (9)$$

Because there is 0≤p≤1, there is $\ln(p)\ln(1-p) > 0$. When $\ln(p)\ln(1-p)$ is the largest, the value of g is the smallest, that is, f is the smallest. We obtain its maximum value by derivation

$$\frac{1}{p}\ln(1-p) - \frac{1}{1-p}\ln(p) = 0 \quad (10)$$

When p=1/2 is calculated, that is, when $k = m/nln(2)$ is approximately equal to $k = 0.7m/n$, the value of g is the smallest, that is, the minimum misjudgment rate f is approximately

$$f = \left(\frac{1}{2}\right)^k \approx (0.6185)m/n \quad (11)$$

From the above discussion, we can know that the value of k mainly depends on the size of the Bloom filter bit vector m and the value of the number of elements in the set n. Studies have shown that if you want to maintain a low false positive rate, the bit vector space used by the Bloom filter should be less than 50%. However, in actual crawler applications, the number of URL links is gradually increasing, so we often cannot determine the values of m and n in advance, which leads to the misjudgment of URLs when n gradually increases beyond the preset threshold. The rate will increase, and the links that have not been crawled will be mistaken for being crawled, which will have a certain impact on the crawling results.

In order to pursue a lower misjudgment rate, based on the basic Bloom filter algorithm, this paper proposes a Hash split distribution filter algorithm based on multiple eigenvalues. The multi-eigenvalue Bloom filter is based on the traditional Bloom filter by adopting the method of multiple eigenvalues and the method of mapping and splitting the Hash function to reduce the misjudgment rate of the basic filter algorithm.

First, let's introduce the multi-eigenvalue Bloom filter. According to the introduction in the previous section, the traditional Bloom filter algorithm only performs a few sets of Hash mappings on the mapped elements themselves, and reflects the mapping results in the modification of the bit vector. On this basis, according to the nature and characteristics of the element to be filtered, we select other attributes or eigenvalues other than the element itself and the element to be filtered to form a multi-attribute bloom filter, that is, a multi-eigenvalue bloom filter. In this algorithm, we use d to represent the number of selected eigenvalues. In the URL deduplication filter, suppose that in addition to the URL content itself, we choose the difference field of the URL as another feature value and the URL together to form a multi-feature value bloom filter. At this time, d is 2, then the bloom filter The mapping process of the device can be expressed as shown in Figure 4 below.

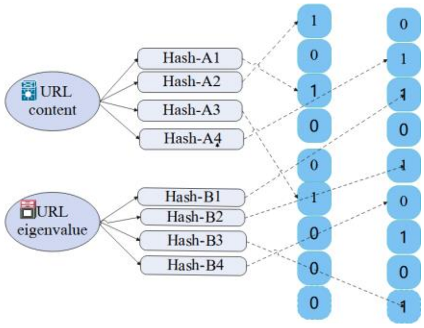

Figure 4 Multi-eigenvalue Bloom filter mapping

Next, the Hash function mapping split is introduced. Hash function mapping splitting is to split the Hash function group of the traditional Bloom filter algorithm. The original group of Hash functions mapped to the same bit vector is split into several Hash function groups. Then, the Hash value of the same group after splitting is mapped to the same group of bit vectors. If it is assumed that there are k Hash functions, and the k Hash functions are divided into L groups, the k/L Hash mapping values of each group correspond to a bit vector, that is, L bit vectors are required. This method actually sacrifices space complexity in exchange for a lower false positive rate. As shown in Figure 5 below, the Hash function is divided into two groups, which correspond to different bit vectors.

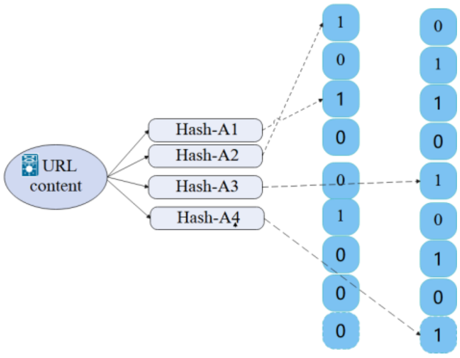

Figure 5 Hash disassembly distribution map filter

The Hash splitting filter algorithm based on multiple eigenvalues proposed in this paper is based on the content of the above two points, fusing multiple eigenvalues and Hash splitting together to achieve the purpose of reducing the misjudgment rate of traditional Bloom filtering algorithms. In the improved algorithm, the number of bit vectors is determined by the number of eigenvalues and the number of hash groups L. Each group of Hash functions corresponds to a bit vector, that is, each eigenvalue corresponds to L bit vectors, and there are d groups of bit vectors corresponding to d eigenvalues.

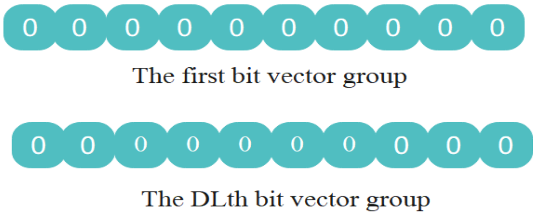

Figure 6 The bit vector initialization process after improvement

The mapping process of the improved algorithm can be expressed as shown in Figure 7 below.

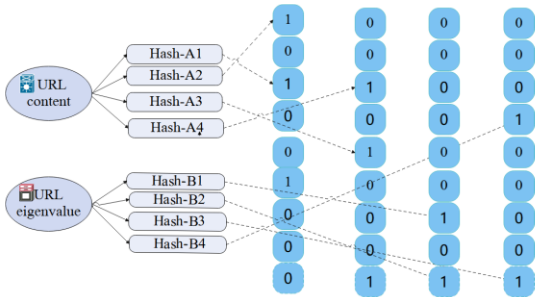

Figure 7 Improved Bloom filter mapping

The improved Bloom filter algorithm is the same as the basic composition of the traditional Bloom filter, which is composed of three basic parameters: k, m, and n. In addition, the improved algorithm adds a parameter d representing the number of eigenvalues and a grouping number parameter L of the Hash function. During the mapping operation, for each feature value of each element to be operated, the corresponding hash value is first obtained through k Hash mapping, and then the corresponding positions of the L bit vectors are set to 1 according to the Hash grouping situation. L represents the number of hash groups. If the value of this position is already 1, no more setting operation is performed, and the first operation shall prevail. When judging whether an element belongs to the set, if the value of the L bit vectors corresponding to each of the d eigenvalues is 1, it is considered that the element already exists in the set.

It is similar to the derivation process of the misjudgment rate of the basic Bloom filter. After the first element passes the first Hash mapping, the probability that a certain bit of the L m-bit vectors is still 0 is

$$1-\frac{1}{Lm} \qquad (12)$$

There are a total of n elements in the set to be operated, and each element requires k Hash operations. When all the n elements are Hash-mapped, the probability p that a certain bit is still 0 is

$$p=\left(1-\frac{1}{Lm}\right)^{kn}=\left(1-\frac{1}{Lm}\right)^{Lmkn/Lm} \qquad (13)$$

From the formula of the natural logarithm e of formula 3, we can get

$$p=e^{-kn/\mathrm{Lm}} \qquad (14)$$

On the basis that n elements have been Hashed, when a new element y comes, if the position of the element corresponding to the bit vector has been set to 1 after k Hash operations, the element y will be considered to already exist in the set. In this case, a misjudgment has occurred. We use f to represent the rate of misjudgment, combined with the above formula, then there is

$$f=(1-p)^{k}\approx\left(1-e^{-kn/\mathrm{Lm}}\right)^{k} \qquad (15)$$

The above is the calculation result for one eigenvalue. For d eigenvalues, there is

$$f = (1-p)^k \approx \left(1-e^{-kn/\mathrm{Lm}}\right)^{dk}$$

It can be seen from the above formula that, compared with the basic filter algorithm, the improved Bloom filter algorithm effectively reduces the value of the false positive rate f by increasing the number of eigenvalues and splitting and mapping the Hash function.

4.INNOVATIVE MODEL OF HUMAN RESOURCE MANAGEMENT OF UNIVERSITY TEACHERS BASED ON INTELLIGENT BIG DATA

Based on the combination of theory and practice, this system achieves the following goals with a B/S multi-layer architecture. (1) Teachers can conveniently query and count local and remote personal information. (2) The autonomous service system is used online for all faculty and staff. (3) The intelligent lesson scheduling sub-system fully solves the laboratory lesson scheduling problems. (4) All functional departments in the school can manage teachers' relevant information in real time according to their authority. (5) Relevant leadership roles can flexibly manage teacher information with this authority. (6) All kinds of information related to teachers (such as teaching task arrangement, teaching plan approval, etc.) truly realize process management. (7) A friendly data interface is designed to make full use of the existing system to import data. (8) A complete role and authority management mechanism has been established to achieve hierarchical management and maintenance. (9) The system super administrator is set up to maintain all the functions of the system background. (10) The system target architecture diagram is shown in Figure 8.

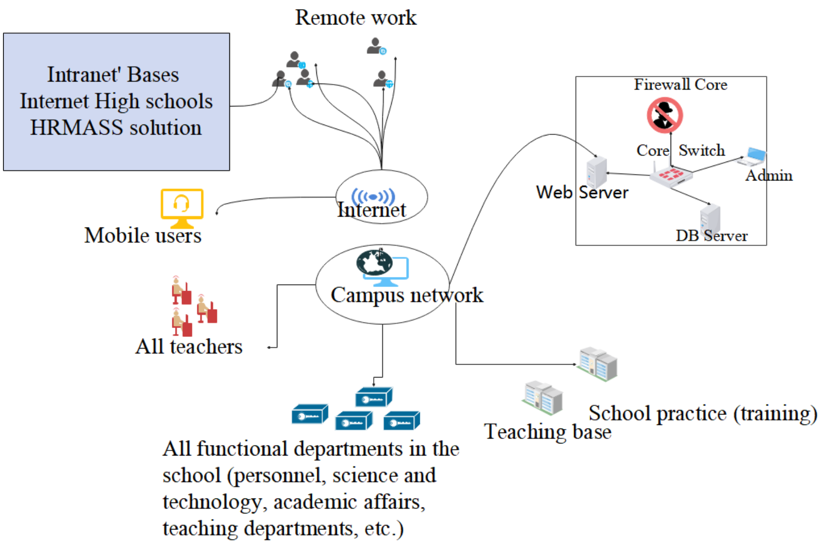

Figure 8 System architecture goals

The human resource management maturity model is an organizational hierarchical promotion system model based on the framework of the capability maturity model (CMM) based on the relevant process domains of human resource management. As a hierarchical improvement structure, P-CMM contains 5 levels. As the maturity level increases, its human resource management practice process also changes accordingly. The classification is shown in Figure 9:

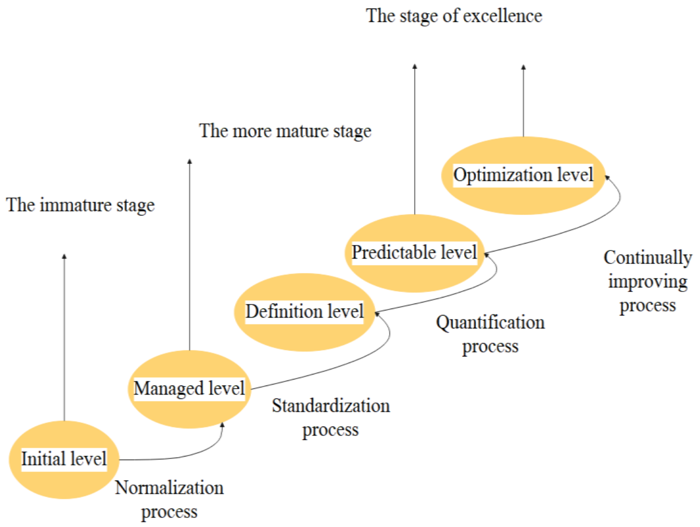

Figure 9 The maturity level of human resource management of university teachers

On the basis of the above research, the experimental research on the human resource management innovation model of universities based on intelligent big data technology constructed in this paper is carried out, and the data mining and innovation effects of the human resources of university teachers are counted, and the results are shown in the following table and Figure 10.

Table 1 Evaluation of the effect of the innovative model of human resource management of university teachers constructed in this paper based on intelligent big data technology

NO	Resource mining	Innovation management	NO	Resource mining	Innovation management
1	95.62	93.52	21	91.14	91.05
2	91.57	93.53	22	91.08	87.60
3	96.00	81.26	23	95.42	79.47
4	92.17	90.60	24	91.23	90.87
5	96.45	93.67	25	94.21	90.34
6	94.52	91.49	26	93.25	87.08
7	91.51	85.20	27	96.67	80.09
8	94.66	86.45	28	93.84	83.24
9	95.99	79.96	29	92.80	82.33
10	94.31	81.50	30	95.18	88.07
11	92.49	86.74	31	95.63	91.22
12	92.00	89.79	32	94.15	92.89
13	91.62	91.31	33	96.00	92.86
14	95.34	82.70	34	94.13	84.01
15	94.44	85.70	35	94.38	86.19
16	93.19	85.19	36	91.83	91.76
17	96.47	87.38	37	91.04	82.12
18	95.85	92.30	38	95.64	79.09
19	93.45	92.00	39	94.91	89.45
20	91.14	91.53	40	95.09	93.58

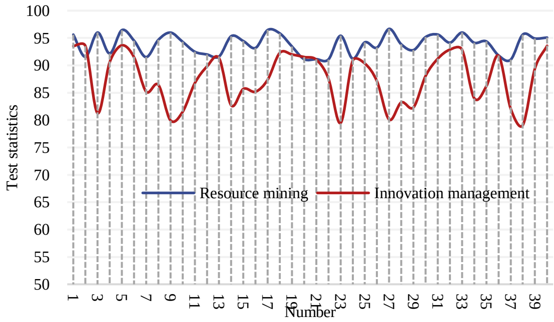

Figure 10 Statistical results of model test

From the above experimental research, it can be seen that the innovation model of human resource management in universities based on intelligent big data technology constructed in this paper can effectively improve the innovation effect of human resource management in universities teachers.

5.CONCLUSION

Judging from the current actual situation, it can be seen that most human resource managers in universities are still in the traditional stage of human resource management in terms of guiding ideology and working methods. Teachers are responsible for specific and arduous affairs, and managers have relatively traditional concepts and methods of human resource management. This research builds an innovative model of human resource management in colleges and universities based on intelligent big data technology to fundamentally explore the potential of teachers, so as to achieve better results in human resource management in universities. This is beneficial to the implementation of teaching and scientific research, and to further exert the role of teachers in talent training. At the same time, it is of great significance to mobilize the enthusiasm of teachers in teaching, scientific research and work, effectively improve the quality of school education and the efficiency of school running, promote the reform of human resource management in colleges and universities, establish a modern human resource management system in universities, and promote the long-term and healthy development of universities.

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