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Talent Competency Model Prediction Platform Based on Intelligent Interactive Personality Testing Software and Intelligent Cluster Analysis

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Abstract. With the development of Internet technology, the application of big data and artificial intelligence (AI) can be seen more and more. Therefore, in modern society, people are no longer satisfied with simple learning and research, but are increasingly pursuing a more in-depth and comprehensive exploration. The talent competency model prediction platform is an important tool in current talent selection and management. However, current research has shortcomings in terms of prediction accuracy and efficiency. This article introduced a talent competency model prediction platform based on intelligent interactive personality testing software and intelligent clustering analysis. This platform utilized advanced technological means to analyze individual personality traits and perform intelligent clustering to predict their competence in the workplace. Research has shown that this method can significantly improve the efficiency and accuracy of talent selection and development, providing decision-making support for enterprises. The average efficiency was 93.92%, and the average accuracy reached 93.4%. In addition, it can significantly reduce costs.

Keywords. Talent Competency Model; Intelligent Interaction, Personality Test Software; Intelligent Cluster Analysis

1. Introduction

In modern society, the competition for talent has become a war between countries and enterprises. Therefore, how to select outstanding talents, cultivate and utilize them is the biggest challenge faced by enterprises today [1]. In management, how to effectively select and cultivate talents is another challenge that enterprises face. In theory, competence is a universal ability that can be used to measure whether an employee is capable of fulfilling the knowledge, skills, personality, and attitude required for their position [2]. Therefore, it is increasingly valued in talent selection and management. However, there are still many issues with competency assessment. Traditional competency assessment methods overly rely on expert knowledge and subjective judgment, requiring a large amount of human and material resources [3]. In addition, these methods are only applicable to a few specialized fields or specific fields.

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Therefore, competency assessment methods based on big data and artificial intelligence have become an important research direction in talent selection and management today [4]. With the continuous deepening of economic globalization and technological revolution, the role of talents in social and economic development is becoming increasingly important. The competition among enterprises is fierce, and the competition for talent is also becoming increasingly fierce [5]. To win in competition, enterprises must first discover, identify, select, cultivate, and retain high-quality talents. However, due to the limitations of traditional recruitment techniques, it is not possible to accurately deliver high-quality talents to enterprises. Therefore, it is necessary to apply more advanced technological means in the recruitment process to screen out more suitable and excellent employees for the enterprise.

Talent competence refers to the comprehensive performance of employees in terms of work attitude, ability, and quality in the workplace. However, traditional talent selection and management methods mainly rely on traditional methods such as interviews for talent selection. Although this method can ensure a certain degree of reliability in the selection process, it cannot meet the new requirements for employee quality and ability in modern enterprise management [6]. Therefore, it is necessary to develop a new type of talent selection tool to better evaluate the quality and ability of employees to more accurately identify high-quality talents.

2. Related Work

In the past decade, big data and artificial intelligence have become a new research hotspot, and many scholars have begun to apply them to talent assessment and management [7]. However, compared to traditional talent evaluation methods, big data technology has three main problems: the arrival of the big data era has led to exponential growth of data; enterprises need to spend a significant amount of manpower and material resources to process massive amounts of data; the traditional talent evaluation methods cannot meet the current requirements of talent management and selection. The traditional talent evaluation methods only consider the differences in abilities between individuals, ignoring the differences in ability levels among individuals. In the big data environment, enterprises are facing problems such as talent loss and high recruitment costs [8]. Therefore, how to effectively solve these three problems and achieve efficient, accurate, and low-cost talent screening and recruitment has become the focus of attention for enterprises.

Currently, some scholars have conducted research on this issue. Among them, common methods include psychological testing, situational testing, interview methods, etc. Simanullang P introduced the five genetic intelligences in personality psychology through the concept of the Stifin test, and provided a new perspective to understand and apply personality psychology from the perspective of genetic intelligence, which has important reference value for fields such as education, human resource management, and personal development [9]. Saputra A provided a new method for talent management using big data, which provided new possibilities for talent management and enabled enterprises to accurately select the most suitable talent from a large number of candidates [10]. In the field of talent management research, some scholars have integrated competency models into talent management. Through this model, organizations can more accurately identify and cultivate employees with the required abilities, thereby enhancing the overall competitiveness of the organization [11]. Sarkar

S explored the global distribution of talent communities and proposed typology of innovation issues and talent characteristics [12]. This article integrated various evaluation software, data analysis platforms, social networks and other information systems to provide enterprises with talent competency model prediction services, talent competency model evaluation services based on data analysis, and talent competency model evaluation services based on big data. In addition, by classifying different groups, the accuracy of data analysis results can be improved.

3. Construction of Talent Competency Model

3.1. Design Framework

The core of this platform is to analyze individuals through artificial intelligence and machine learning technologies to predict their workplace competence. By extracting individual basic attributes and utilizing various algorithms to establish a new talent competency model, it helps enterprises better select and manage talents. At present, intelligent interactive personality testing software is a relatively mature tool. In practice, it has been found that when using this software, there are certain limitations in analyzing individual attributes due to the limited basic information of users such as age, gender, and educational background. To address this issue, this article introduces intelligent clustering analysis technology, which utilizes the basic attribute information provided by users to determine the group they belong to. This method can increase user engagement and enhance the accuracy and reliability of data analysis results. The basic workflow of the platform is shown in Figure 1.

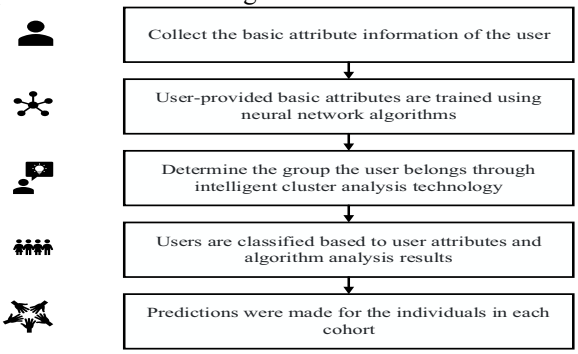

Figure 1. Basic workflow of the platform

This platform uses algorithms based on neural network algorithms to train the basic attribute information provided by users. During the training process, users provide basic attribute information about their performance in different groups. Then, the platform uses neural network-based algorithms to analyze the basic attributes provided by users and determines which attributes belong to a certain group through a series of calculations. Finally, the platform classifies users based on the information and algorithm analysis results provided by the users. In cluster analysis, this article uses distance measurement to calculate the similarity between different data objects. This article chooses Euclidean distance for calculation, which is a more intuitive method.

$$d_{ij} = \sqrt{\sum_{k=1}^{n} (x_{ik} - x_{jk})^2} \tag{1}$$

Among them, d_{ij} represents the Euclidean distance between data objects i and j; x_{ik} and x_{jk} represent the values of data objects i and j in the k-th feature; n represents the number of features of data objects. This classification method can avoid errors based on personal experience or simple linear calculations. In practical applications, this article uses two different age, educational background, work experience, and other attribute information groups to test users, and divides them into three different groups (young group, middle-aged group, and elderly group). Then, neural network algorithms are used for clustering analysis and normalized using the following formula.

$$a_{ij} = \frac{a_{ij} - \min\limits_{j}(a_{ij})}{\max\limits_{j}(a_{ij}) - \min\limits_{j}(a_{ij})} \tag{2}$$

Among them, a_{ij} represents the rating of the i-th object on the j-th attribute, while $\max\limits_{j}(a_{ij}), \min\limits_{j}(a_{ij})$ represent the maximum and minimum ratings of all users on the j-th attribute, respectively. Finally, this article predicts the competency of each individual in each group. Based on the analysis of results and accuracy, this platform can provide important reference for enterprises to select and manage talents.

3.2. Software Functions

The function of testing software is that testers can use it for online testing. Firstly, the user needs to log in to the software. Only when users conduct online testing can testers see the test results. During the testing process, users can select testing items by clicking the buttons on the screen and make corresponding choices according to their preferences. Throughout the entire process, users do not need to intervene, nor do they need to spend time and energy adjusting their mood. In addition, the software also supports various data analysis methods, such as statistical analysis, cluster analysis, etc., to meet the needs of different users. The software also supports functions such as custom quizzes and custom ratings. Firstly, before entering the test, it is necessary to detect and classify each person's personality. Then, the tested individuals are divided into four categories: the first category is thinking oriented; the second type is sensory type; the third type is intuitive; the fourth type is emotional. Through intelligent clustering analysis algorithms, the data is trained and tested, and is divided into four different types. When developing models, different types of models are selected for training and testing based on the individual characteristics of the testers. Finally, the output of the model is passed to the user through a web interface. Throughout the entire process, users can control the usage of the software and the way results are displayed.

3.3. Platform Implementation

The intelligent interactive personality testing software mainly includes five functional modules: personality testing, learning function, personality analysis, intelligent clustering, and report generation. Among them, the personality testing module automatically generates a personality trait report based on the personality traits selected by the user, and displays different types of users. At the same time, testing reports can be updated in a timely manner based on user feedback. In the learning function, different types of test questions can be learned through this platform to understand the user's personality traits. In addition, the test results can also be used to understand the user's personality traits in other aspects. Personality analysis can analyze different types of users and obtain corresponding results. Intelligent clustering: based on each type of user, clustering analysis algorithms are utilized to classify them, which can help companies understand the personality and ability characteristics of different types of employees, thereby cultivating them in a targeted manner and enabling them to better leverage their advantages. This article ensures that the process of processing personal data complies with data privacy and security standards when using intelligent technology for talent selection, including the application of encryption technology and confidentiality agreements for user data. In the report generation module, relevant reports can be generated through the platform, including each person's personality traits and score, as well as their actions in the company. The entire platform stores data such as personality traits and scores of each individual through a database, and completes corresponding analysis and output results through programming.

3.4. Experimental Design

This study aims to compare the differences in efficiency, accuracy, and cost between the method designed in this article and traditional methods. In terms of efficiency, the time and resource investment required for the talent selection process between the two methods are compared. In terms of accuracy, the predictive accuracy of both methods in selecting employees is evaluated. The dataset information is shown in Table 1.

Table 1. Dataset feature data

Employee ID	Age	Educational qualifications	Work experience (Year)	Personality trait score	Selection results
A	30	Undergraduate	5	93	Pass
B	25	Master	1	88	Pass
C	22	Undergraduate	0	80	Did not pass
D	28	College	5	87	Pass
E	26	College	3	76	Did not pass
F	23	Undergraduate	1	84	Pass
G	27	Master	2	90	Pass
H	33	Undergraduate	10	92	Pass

Each dataset includes the personal background of employees (such as age, education, work experience, etc.), personality traits scores, and selection results. This article uses two datasets for experimental comparison, where A, B, and D are one group, using traditional methods, and F, G, and H are one group using the method designed in this article. This article also collects cost data from two methods in the talent selection process, including time cost, human resource investment, and related economic costs.

4. Data Analysis

4.1. Efficiency

The efficiency data obtained through experiments in this article is shown in Figure 2, which includes data obtained by six employees through different methods.

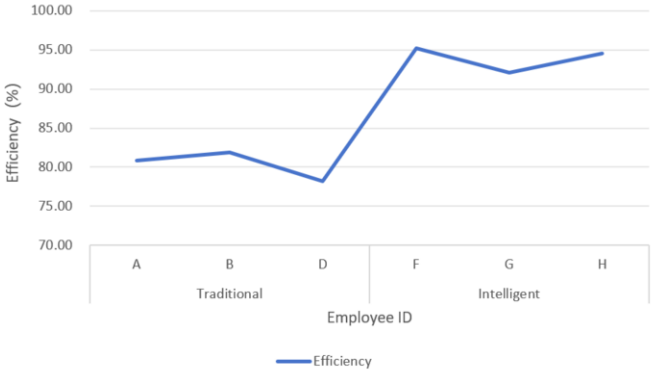

Figure 2. Efficiency data

From Figure 2, it can be seen that the efficiency of employees using traditional methods fluctuated around 80%, and there were many problems with traditional selection methods in talent positioning, incentive mechanisms, and other aspects. Especially in the interview process, more emphasis was placed on the assessment of personal resume, skills, and other aspects, while neglecting the assessment of personal qualities, teamwork ability, and other aspects. In contrast, the selection method based on intelligent interactive personality testing software and intelligent clustering analysis significantly improved the work efficiency of employees. The lowest efficiency also reached 92.07%, and the highest efficiency reached 95.16%. This can more accurately identify candidates who are suitable for the corporate culture and work needs, thereby improving employee work efficiency. Through intelligent interactive personality testing software and intelligent clustering analysis, employees can have a deeper understanding of their personality traits, work habits, etc., enabling them to better meet job requirements.

4.2. Accuracy

In addition to conducting data analysis on efficiency, this article also conducted statistics on the accuracy of employee work content. The statistical results are shown in Figure 3.

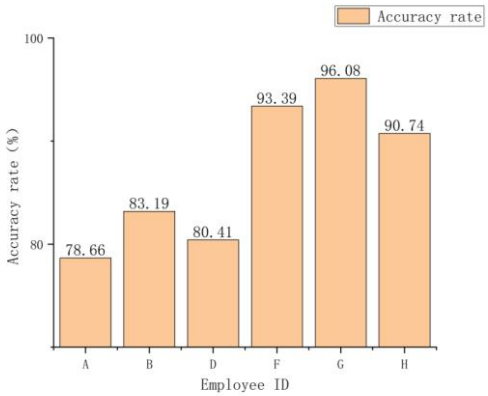

Figure 3. Accuracy data

The data in Figure 3 showed that the accuracy of traditional methods ranged from 78.66% to 83.19%, while the method studied in this paper reached 90.74% to 96.08%, which was much higher than traditional methods. When selecting talents, traditional selection methods place more emphasis on the professional skills and experience of applicants, lacking a comprehensive consideration of personality and team cooperation, resulting in a higher probability of selecting the wrong candidates. Based on intelligent interactive personality testing software and intelligent clustering analysis methods, in-depth research was conducted on the personality characteristics of job applicants, and clustering analysis and other techniques were used to classify job applicants to accurately screen out the most suitable candidates. The reason for this difference is that the system designed in this article has a high level of accuracy, which can better explore the individual characteristics of job applicants; in addition, by intelligently clustering candidate objects, it is possible to accurately partition them and effectively solve screening errors caused by subjective factors.

4.3. Cost

Figure 4 shows the cost data for two methods.

Figure 4. Cost data

The data in Figure 4 clearly demonstrated the advantages of the selection method based on intelligent interactive personality testing software and intelligent clustering analysis in terms of human resource costs. Compared to traditional methods, it greatly reduced human resource costs while also saving time and other related costs. Traditional decision-making methods for employment have subjective biases, which increases the likelihood of errors and increases the investment of human resources by employers. The selection method based on intelligent interactive personality testing software and intelligent clustering analysis can quickly and accurately screen and select candidates through automation. Intelligent interactive personality testing software and intelligent clustering analysis algorithms were continuously improved to enhance their operational efficiency. More efficient algorithms can reduce the use of computing resources, thereby lowering operational costs. Table 2 shows the average calculation data of the overall evaluation indicators.

Table 2. Calculation of mean evaluation indicators

Method	Efficiency (%)	Accuracy rate (%)	Cost ($)
Traditional	80.32	80.75	4066.67
Intelligent	93.92	93.4	2400

The data in Table 2 showed that the average efficiency of traditional methods was 80.32%, while the average efficiency of the method studied in this paper was 93.92%. In terms of accuracy, the average accuracy of traditional methods was 80.75%, while the method studied in this article had an average accuracy of 93.4%. This indicates that intelligent interactive personality testing software and intelligent clustering analysis have higher efficiency and accuracy in the application of talent competency model prediction platforms.

5. Conclusions

This article used intelligent interactive personality testing software and intelligent clustering analysis technology to study a talent competency model prediction platform based on intelligent interactive personality testing software and intelligent clustering analysis. The differences in efficiency, accuracy, and cost between traditional human resource selection methods and selection methods based on intelligent interactive personality testing software and intelligent clustering analysis were compared and analyzed. This study found that methods based on intelligent interactive personality testing software and intelligent clustering analysis were significantly superior to traditional methods in all aspects.

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References

[1] Kravariti F, Tasoulis K, Scullion H. Talent management and performance in the public sector: the role of organisational and line managerial support for development[J]. The International Journal of Human Resource Management, 2023, 34(9): 1782-1807.
[2] Youssef Elhanafy E, Moh Samir El Hessewi G. Effect of talent management training program on head nurses leadership effectiveness[J]. Egyptian Journal of Health Care, 2021, 12(4): 351-361.
[3] McCartney S, Murphy C, Mccarthy J. 21st century HR: a competency model for the emerging role of HR Analysts[J]. Personnel review, 2021, 50(6): 1495-1513.
[4] Persaud A. Key competencies for big data analytics professions: A multimethod study[J]. Information Technology & People, 2021, 34(1): 178-203.
[5] Mohamed Jais I R, Yahaya N, Ghani E K. Talent Management in Higher Education Institutions: Developing Leadership Competencies[J]. Journal of Education and e-Learning Research, 2021, 8(1): 8-15.
[6] Bani-Hani J. The moderating influence of managers strategic thinking on the effect of talent management on organization core competency[J]. Management Science Letters, 2021, 11(1): 213-222.
[7] Li X, Long Y, Fan M. Drilling down artificial intelligence in entrepreneurial management: A bibliometric perspective[J]. Systems Research and Behavioral Science, 2022, 39(3): 379-396.
[8] Zheng Y, Liu S. Bibliometric analysis for talent identification by the subject–author–citation three-dimensional evaluation model in the discipline of physical education[J]. Library Hi Tech, 2022, 40(1): 62-79.
[9] Simanullang P. Application of Introduction To Personality Psychology 5 Genetic Intelligence Through The Concept of Stifin Test[J]. ENGGANG: Jurnal Pendidikan, Bahasa, Sastra, Seni, dan Budaya, 2022, 3(1): 100-109.
[10] Saputra A, Wang G, Zhang J Z. The framework of talent analytics using big data[J]. The TQM Journal, 2022, 34(1): 178-198.
[11] Shet S V, Bajpai A. Integrating competency modeling in talent management: Framework for implications in a disruptive environment[J]. Thunderbird International Business Review, 2023, 65(1): 177-187.
[12] Sarkar S, Kedas S. Globally distributed talent communities: A typology of innovation problems and talent characteristics[J]. Thunderbird International Business Review, 2023, 65(1): 89-102.