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Research Article

The Establishment of College Student Employment Guidance System Integrating Artificial Intelligence and Civic Education

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A logical and appropriate job advising system for college students is the only way to address the current dire work scenario for recent graduates in a society that is becoming more and more competitive. The process of building new career advice systems for college students is still fraught with many major issues. Existing problems are manifested in the lack of a perfect employment guidance system for college students and a lack of effective ideological and political education, which leads to the inability of college students to establish a correct employment concept. At the same time, the recommendation method used in the current college student employment guidance system is not reasonable enough and only considers students' one-way preference for employment units. Then, the history of one user's employment is likely to lead to unreliable negative samples, which affects the recommendation performance. In addition, the current employment recommendation system cannot fully integrate the service function, management function, education function, and research function of the employment guidance system. In this paper, we address the aforementioned issues and propose an unique career counseling system for college students by combining algorithmic recommendation with ideological and political education. The system adaptively aggregates the preferences and needs of students and employers and fully integrates several functions of the student career competence and career guidance system. The experimental results show that the establishment of a college students' employment guidance system integrating artificial intelligence (AI) and civic education not only has better interpretability compared with the traditional employment guidance system but also has a higher area under curve (AUC). Furthermore, we also discuss the importance of ideological and political education and referral systems in the work of the career guidance system through ablation experiments. The results show that the AUC values of integrating ideological and political education and recommender systems were higher than those of integrating only ideological and political education or recommender systems. Therefore, establishing an employment guidance system for college students that integrates AI and civic education can effectively guide students' employment. At the same time, the college student employment guidance system proposed in this paper can offer employment guidance courses in colleges and universities, help graduates to solve their doubts, and make graduates adjust their psychological state in the process of job hunting.

1. Introduction

In recent years, the number of college graduates has been increasing year by year. The employment of graduates has been an unprecedented challenge. Whether college students can successfully find employment after graduation has become a universal concern of the whole society. With the reform of the market-oriented employment system and the expansion of college enrollment, the employment situation faced by college students is becoming more and more severe. Many graduates face the problem of unemployment after

graduation. The development and improvement of a college students' employment guidance system, as well as the guidance and service of college students' employment, are receiving increasing attention from society [1]. In response to the problem of the difficult employment of graduated college students, all colleges and universities around the world have established various kinds of college students' employment guidance systems. The establishment of a scientific college students' employment guidance system can not only improve the employability of college students but also improve the value of human resources and create

conditions for society to establish a fair and stable employment environment [2, 3].

The United Kingdom (UK) is the first country to pay attention to the establishment of a career guidance system for college students. Nowadays, the career guidance system of college students in the UK is well developed and can make the coordination between society, school, and the state more coordinated. Reviewing the history of the development of college students' career guidance systems, in the 1960s, the British career guidance service entered a rapid development stage. The college student employment guidance system has helped many graduates find suitable jobs. The results of a report point out that career guidance for graduates needs to evolve with the times while suggesting that major universities should set up their own career guidance agencies to be responsible for career guidance services for college graduates [4, 5]. This report also describes how the basic framework of a career guidance system in UK universities should include key elements such as counseling services, advice information, contacting employers, and arranging job interviews. In 2011, European countries, represented by the UK, discussed that the direction of the career guidance system is to upgrade career guidance to lifelong career guidance, in which three strategies were also proposed. First, we should improve the ability of employment guidance personnel and ensure the quality of employment guidance. Second, the government should integrate the labor market and labor resources and analyze the influencing factors of the job market and resources [6, 7]. Third, society needs to give full play to the role of public employment service in employment guidance. On the other hand, Elaine Collinson emphasizes that small and medium-sized enterprises have greater potential to accommodate college students' employment and proposes that the employment guidance system includes employment guidance institutions, employment guidance tools, and employment guidance content. Elaine Collinson also specifies that the government should promote the ideological and political education of college students in career guidance institutions as well as add entrepreneurship education courses to the career guidance curriculum [8, 9].

In 2010, there were 5.754 million graduates from regular institutions of higher learning nationwide, and the number of graduates in 2021 is expected to reach 9.09 million. Over the past decade, the total number of college graduates has increased significantly, and their employment has also changed a lot with the development of the social economy. After long-term development and summary, the function of a college student's employment guidance system can be described in the following four aspects. First of all, the most important thing is the service function. The essence of the college student employment guidance system is to complete the employment service function in the university field. Therefore, in the career guidance system of college students, career guidance is a service that is student-centered and enthusiastic about serving students. The employment guidance system for college students tracks the state of the labor market, investigates, examines, and anticipates its trends and changes, and serves as a foundation for developing and carrying out the school's primary setting,

curriculum, and training plan. Additionally, it records and looks into college students' career status as well as how society perceives graduates [10, 11]. On this basis, the school offers students rigorous course instruction to assist college students in choosing the best path to a smooth transition into the workforce. In the coming period, the function of the college career guidance service system will be further changed to strengthen the service, dilute the management, and enhance the overall consciousness, service consciousness, and quality consciousness [12, 13]. At the same time, the college employment guidance service system will vigorously promote the employment and market-oriented higher education reform and promote the sustainable development of higher education. To better serve the students, the career advice staff will gradually become more competent and knowledgeable. Second, the college students' career guidance service system has a management function. The management responsibilities include being responsible for the connection between the school and enterprises, government, talents, and the market, creating a communication platform for students and enterprises, and building and managing the career guidance team. Employment guidance in colleges and universities has moved from education management to service guidance, forming a graduate employment guidance system with service function as the main focus [14, 15]. However, the above phenomenon does not mean that the employment guidance system of college graduates does not need education management, and the two are not mutually exclusive, but promote each other. In addition, the employment guidance system for college graduates also assumes the function of education for students' employment and infiltrates the employment guidance concept of colleges and universities into the teaching mode to stimulate students to consolidate their professional theoretical foundation and strengthen their practice. Finally, research is another component of the college student employment advice system. The school keeps track of the employment status of graduates and the evaluation and requirements of the society on graduation, so as to keep abreast of the development trends of career and workplace. The employment guidance system for college graduates can analyze and predict the trends in the job market and career development through the collected information and provide a reference basis for the formulation and implementation of the school's major setting, curriculum setting, and cultivation plan [16].

In order to give full play to the function of the employment guidance system for college graduates, colleges and universities should also make it clear that employment guidance and service work is an important part of school quality education. At the same time, employment guidance and service is also an effective way of moral education in colleges and universities. Employment guidance, service, and ideological and political education are inseparable. Employment guidance and service should be combined with ideological and political education to help college students find employment successfully [17, 18]. Employment guidance and service are the most important components of the employment guidance system for college graduates, which

take career planning and ideal belief education as its core to help graduates establish a correct concept of career selection. The career guidance teachers of college students in colleges and universities first provide guidance to graduates in employment and further provide ideological and political education to graduates, which will strongly promote the innovation and expansion of the ideological and political education of schools in terms of form and content. The objectives and requirements of ideological and political education are permeated throughout employment guidance and services, and the effects of ideological and political education are also reflected through employment guidance and services. At present, graduates' thoughts are complicated by factors such as social environment and employment situation. Attention should be paid to strengthening the ideological and political education of graduates in employment guidance and services. Teachers should help students establish a correct view of employment through ideological and political education.

However, with the rapid development of society and the economy, the previously established college career guidance system has gradually revealed some fatal problems. On the one hand, the employment guidance system for college students is not perfect and lacks effective ideological and political education, which leads to the inability of college students to establish a correct employment concept. On the other hand, the recommendation method used in the current college students' employment system is not reasonable enough, only considering students' one-way preferences for employment units, and the historical records of one user's one employment easily lead to unreliable negative samples, which affect the recommendation performance [19]. At the same time, the current employment recommendation system cannot fully integrate the service function, management function, education function, and research function of the employment guidance system. Therefore, in view of the above-mentioned problems, this paper first elaborates the importance and key points of ideological and political education in the establishment of college students' employment guidance system, so as to draw the attention of educators [20]. We adopt the method of integrating recommendation algorithms and ideological and political education to establish a set of novel employment guidance systems for college students. Second, this paper uses recommendation algorithms in AI to adaptively aggregate the preferences and needs of students and employers in both directions. The experiment is conducted on the employment data for undergraduates (EMDAU), a real dataset of five graduates from a university. The results show that the employment guidance system of college students integrating AI and civic education has better interpretability than the traditional employment guidance system and can fully integrate the service, management, education, and research functions of the employment guidance system. The employment guidance system established in this paper has a higher value of AUC compared to the traditional system, which directly demonstrates the rationality of the method in this paper.

2. Related Works

McLaren [19] examined the effectiveness of computer-assisted career guidance systems. Results compared with the conventional control group show that the computer-aided vocational guidance system is more structured. He also investigated moderators of the effects of occupational interventions. Based on big data, Qi and Zhang [21] designed a personalized employment guidance system for college students based on big data. The system presented by Qi and Zhang designs a B/S structure-based system framework by collecting information about students' employment environments and using the Tptmf algorithm to recommend employment resources for users. Watts [22] not only explored the relationship between career guidance and career orientation and technical vocational education and training but also examines the concepts of career guidance and career orientation and defines the three main elements of career information, career counseling, and career education. He also analyzes the main conceptual elements of providing career guidance, including the increasingly important role played by technology. Fang [23] conducted extensive statistics on the employment decision factors of college graduates in recent years in order to further explore and guide the employment of higher education students. Based on the classification of information data, he analyzed the impact of information data classification on the application of career guidance for college students. Harris [24] examined the history of the development of computer-assisted career planning systems and the promising potential of career guidance systems as part of the implementation of career guidance services in developing countries. Korna and Katane [25] examined specific measures for implementing career guidance in schooling settings that promote students' professional autonomy. Also in home education, they advocate the establishment and recognition of a number of career development guidance systems, including counseling and student career support methods and forms, with a focus on career planning courses.

3. Modeling Methods

3.1. Establishment of Recommendation System.

For the problem of negative sample disbelief in employment recommendation data, this paper designs a similarity-based random negative sampling module, including 2 steps of similarity calculation between students and similarity calculation between employment units, and similarity-based random sampling [26, 27]. This paper designs the calculation of interstudent similarity and interunit similarity:

$$\text{sim}\left(stu_i, stu_j\right) = \sum_{k=1}^{N_d} \text{bool}\left(f_{ik} = f_{jk}\right)$$
$$+ \sum_{k=1}^{N_c}\left(1 - |f_{ik} - f_{jk}|\right), \quad i \neq j, \qquad (1)$$

$$\text{sim}\left(unit_i, unit_j\right) = \sum_{k=1}^{M_d} \text{bool}\left(f_{ik} = f_{jk}\right), \quad i \neq j,$$

where $\mathrm{sim}(stu_i, stu_j)$ denotes the similarity between students a stu_i and $bstu_j$, N_d and N_c denote the number of discrete and continuous features of students, respectively, and f_k denotes the value of the kth feature. $\mathrm{sim}(\mathrm{unit}_i, \mathrm{unit}_j)$ denotes the similarity between employment units unit_i and unit_j, and M_d denotes the number of discrete features of employment units.

This work employs the strategy of maintaining random sampling while taking into consideration similarity in order to produce negative samples with high confidence and avoid significantly altering the sample distribution of the training set. First, the similarity between student u and other students and the similarity between student u's employment units and other employment units are calculated, and the employment units of the most dissimilar top N students and the most dissimilar top N units are selected as the high confidence negative sample set. Then, the negative samples are randomly sampled from the negative sample set to generate negative samples for training [28, 29].

The interpretable module of employment intention and the recommendation module of employment unit are designed simultaneously using the idea of multitask learning. The characteristics are as follows: the two tasks share feature embedding layer parameters; that is, after obtaining the embedding of student and unit features, the two tasks are modeled, respectively [30, 31]. Aiming at the evolution problem of employment intention, the students' academic performance is used to assist the employment intention modeling, and the gated recurrent unit (GRU) [32] learning method is adopted, which is calculated as

$$G_t = \mathrm{GRU}(G_{t-1}, x_t), \quad t = 1, 2, \ldots, 6. \qquad (2)$$

where G_t is the hidden state of students' scores in the t semester, and $x_t \in R^d$ is the embedding vector of students' scores in the t semester. The hidden state G_6 of students' grades in the last semester is taken as the evolution result of students' employment intention, which is spliced with the embedding vector of students and unit features to obtain the embedding vector used to represent students' employment intention. The calculation formula is as follows:

$$E = \mathrm{concat}([P_1, P_2, \ldots, P_M, G_6]), \qquad (3)$$

where $P_m \in R^{M \times d}$ is the embedding vector of student features. Finally, multilayer perceptron [33] is used to model employment intention, which is calculated as follows:

$$O_p = \mathrm{Softmax}(\mathrm{MLP}(E)). \qquad (4)$$

The explanation module based on employment characteristics can be divided into the attention mechanism of extracting students' employment preferences and the attention mechanism of extracting unit ability requirements. The attention mechanism of students' career preferences may be extracted in three phases. Given a pair of students and employment units under the condition of information, students' characteristics of the embedded vector are obtained by embedded layer $P_m \in R^{M \times d}$, lateral characteristics of embedded vector $Q_n \in R^{N \times d}$ and employment units, the M and N, respectively, students side characteristic number
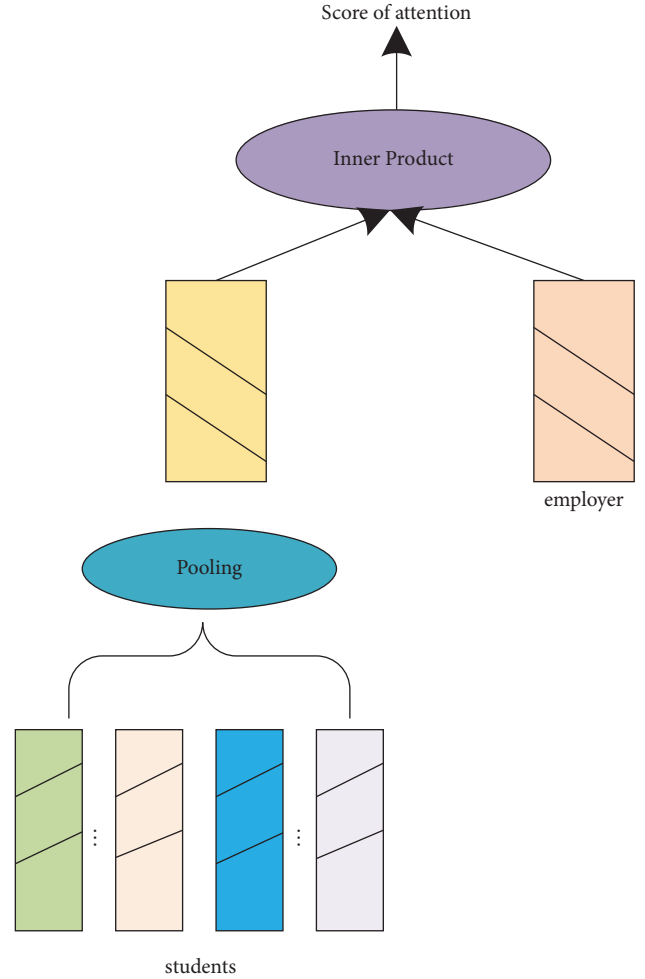

FIGURE 1: Extraction of students' employment preferences.

and employment units, M features for students of the first M, N for the employment unit characteristics of the first N, d for embedded vector dimensions. Through the sum-pooling operation, the student feature embedding vector P_m is aggregated, and the student representation vector P^s is obtained as follows:

$$P^s = \sum_{m=1}^{M} P_m. \qquad (5)$$

The student representation vector P^s is used as the query vector to calculate the weight of attention, which is used to calculate the preference degree of students for different characteristics of employment units [34, 35]. The structure is shown in Figure 1, and the calculation method is as follows:

$$\omega_n = \frac{Q_n^T P^s}{\sum_{k=1}^{N} Q_k^T P^s}. \qquad (6)$$

The calculated attention weight ω_n indicates the preference degree of students for the n-th feature of the employment unit.

The weighted sum of unit feature embedding vectors is carried out by using the weight of attention, and the

embedding vector P of students' employment preference is obtained as follows:

$$P = \sum_{n=1}^{N} \omega_n Q_n. \tag{7}$$

There are three steps to extracting the attention mechanism required by unit ability. The embedding vector $P_m \in R^{M \times d}$ of student features and the embedding vector $Q_n \in R^{N \times d}$ of employment unit features are obtained. Through the sum-pooling operation, the embedding vector Q_n of employment unit features is aggregated, and the representation vector Q^u of employment unit is obtained as follows:

$$Q^u = \sum_{n=1}^{N} Q_n. \tag{8}$$

The employment unit representation vector Q^u is used as the query vector to calculate the attention weight, which is used to calculate the preference degree of employment units for different characteristics of students. The structure is shown in Figure 2, and the calculation method is as follows:

$$\omega_m = \frac{P_m^T Q^u}{\sum_{k=1}^{M} P_k^T Q^u}. \tag{9}$$

The calculated attention weight ω_m represents the preference degree of the employment unit for the m-th characteristic of the student.

The weight of attention is used to weighted sum the embedding vectors of students' features, and the embedding vector Q required by unit ability is obtained by the specific calculation method as follows:

$$Q = \sum_{m=1}^{M} \omega_m P_m. \tag{10}$$

This mechanism not only uses the ranked importance of the characteristics of the employment unit to explain the students' employment preferences but also uses the ranked importance of the characteristics of the students to explain the ability requirements of the employment unit. Specifically, according to (6) and (9), the attention scores (ordinal importance scores) output by the attention mechanism requiring students' employment preferences and unit ability in reciprocity constraints are taken as the explanation of feature level. The normalized attention weight $\omega_n \in (0, 1)$ calculated from (6) represents the students' attention score to the NTH feature of the employment unit, which is the explanation of students' employment preference. The normalized attention weight $\omega_n \in (0, 1)$ calculated from (9) represents the attention score of the employment unit on the m-th feature of students, namely, the unit's ability requirement explanation.

The core of the employment recommendation module is based on GRU aggregation [36] of employment preference and ability requirement features; i.e., the aggregation weights are computed adaptively and dynamically using neural networks, which are calculated as follows:
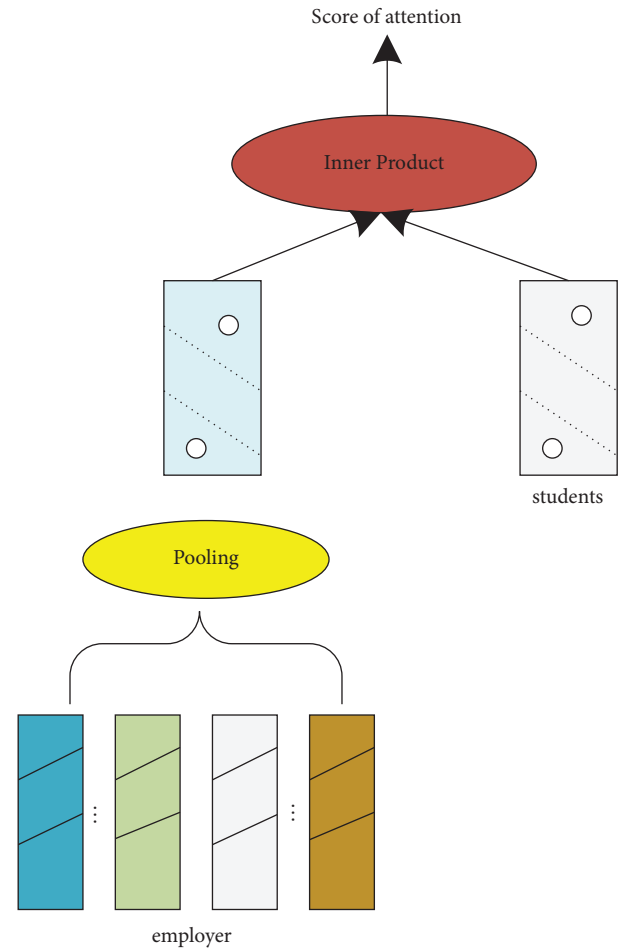

FIGURE 2: The attention mechanism required to extract unit ability.

$$R = \omega P + (1 - \omega) Q, \tag{11}$$

where the adaptive weight ω is implemented by a binary neural network [37], calculated as

$$\omega = \sigma\left(W_p P + W_q Q\right), \tag{12}$$

where W_p and W_q are the parameter matrices of the neural network, respectively.

3.2. Employment Guidance System for College Students Integrating Recommendation System and Ideological Education.

A recommendation algorithm is a kind of algorithm in computer specialization. Recommendation algorithms can use some mathematical algorithms to guess what users are likely to like. The employment guidance system of college students, integrating AI and ideological and political education, is a system of human-machine synergy. As for the establishment of an employment guidance system, we fully integrate the service function, management function, education function, and research function of the employment guidance system. Meanwhile, using AI technology based on semantic parsing, precise recognition, and data mining, we analyze students' career ability models and career interest points, carve students' career orientation and career ability
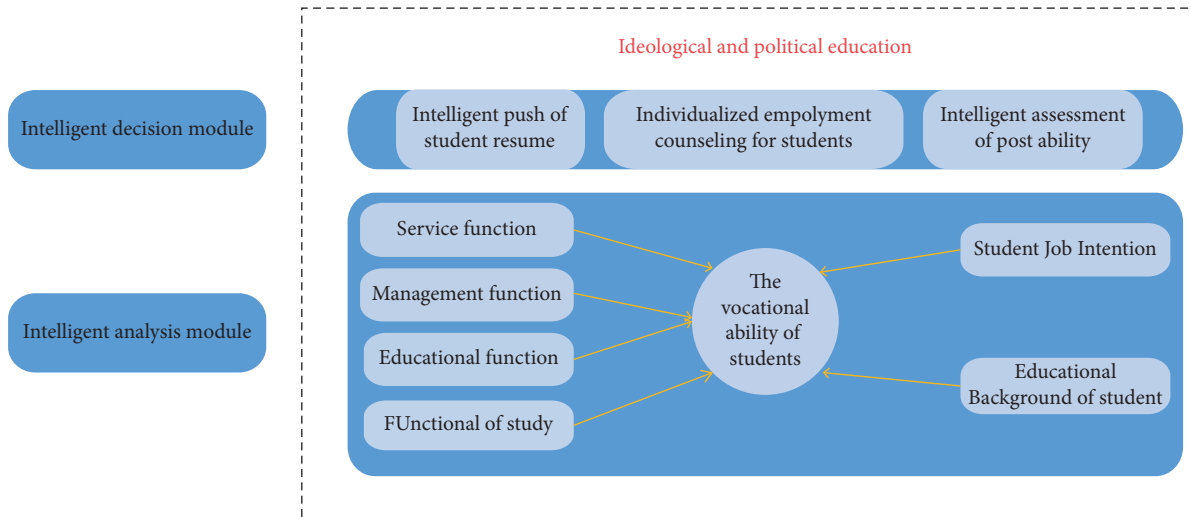
FIGURE 3: The structure of the employment guidance system for college students integrating AI and ideological and political education.

portraits, and match them by relying on relationship chain through the mixed ranking algorithm of recruitment information flow.

On the one hand, the employment guidance system for college students is not perfect and lacks effective ideological and political education, which leads to the inability of college students to establish a correct employment concept. On the other hand, the recommendation method used in the current college students' employment system is not reasonable enough, only considering students' one-way preferences for employment units, and the historical records of one user's one employment easily lead to unreliable negative samples, which affect the recommendation performance. At the same time, the current employment recommendation system cannot fully integrate the service function, management function, education function, and research function of the employment guidance system. These problems will lead to employment not in line with students' interests.

In terms of ideological and political education, we are deeply aware of the fact that graduates are often in a contradictory position between the needs of the country, the responsibilities of society, and the interests of individuals when choosing employment. How to view the relationship between these three determines the value orientation of their career choice and affects the formation of a correct career choice. When establishing the employment guidance system, we need to provide students with appropriate ideological and political education, so that graduates understand that their personal ambitions cannot be realized in isolation and that only by closely combining them with the requirements of their contemporaries and people can their values be fully reflected. In this way, students should be guided to establish a correct employment outlook so that students and enterprises can find effective ways to solve problems.

In summary, we will establish intelligent pushing of students' resumes, personalized counseling of students' employment, and intelligent assessment of job ability in the intelligent decision-making module, strengthen the ideological and political education of college students, and

infiltrate the content of college students' employment education into the teaching of ideological and moral and professional courses. Meanwhile, in the intelligent analysis module, taking students' job-seeking intention and students' educational background as reference factors, we will consider the service function, management function, education function, and research function of the career guidance system with students' vocational ability integrated. Figure 3 shows the structure of the college students' career guidance system, integrating AI and ideological and political education.

4. Discussion and Analysis of Results

The statistical information of EMDAU in the data set used in this experiment is shown in Table 1, where the number of users is the sum of the graduates of the five years, the employment unit is the sum of the employment units of the five years of students, and the interaction record is the information pair of students and employment units (expressing the employment relationship between students and employment units). 10 discrete features and 6 continuous characteristics made up the student features in this data collection. The characteristics of employment units include six discrete features. The employment intentions in the data set are summarized by experts into three types: studying abroad, studying in China, and contracting for employment, as shown in Figure 4.

In this paper, according to the graduation year of students, the data of the two graduates with a small number are, respectively, used as the validation set of 769 items and the test set of 2031 items, and the data of the other three graduates are used as the training set of 5469 items.

AUC is a widely used evaluation index. AUC is an index to measure the performance of binary classification model, which measures the probability that positive samples are ranked before negative samples in the test set, reflecting the ranking ability of the model [38, 39]. This paper uses AUC as an evaluation index to measure the performance of

TABLE 1: Statistical information of EMDAU.

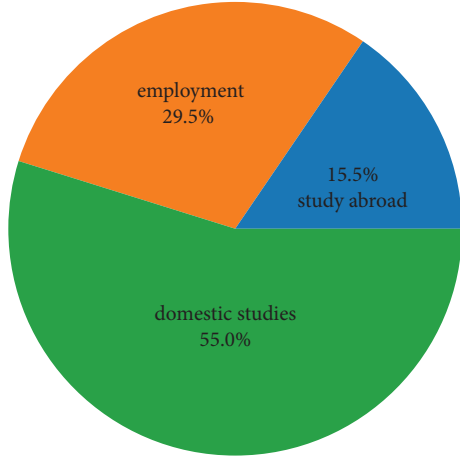| The number of users	Unit of employment	Number of interaction records	Sparsity/%
8450	1423	8756	0.065

FIGURE 4: The distribution of employment intention in dataset.
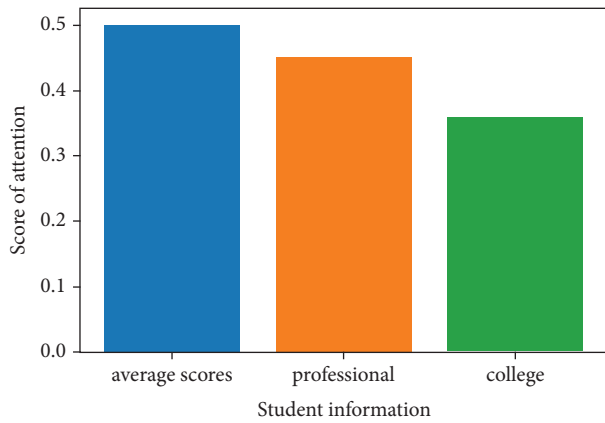
FIGURE 5: Interpretation based on student characteristics.

FIGURE 6: Interpretation based on unit characteristics.
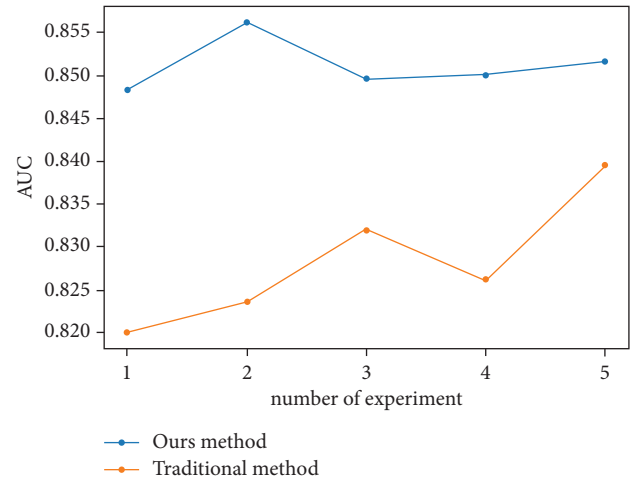
FIGURE 7: Comparison of AUC between the proposed method and the traditional method.

employment recommendation, and its calculation method is as follows:

$$AUC = \frac{\sum y_{pos} > y_{neg}}{N_{pos} \times N_{neg}}, \tag{13}$$

where y_{pos} and y_{neg} are the predicted values of the model for positive and negative samples, respectively, and N_{pos} and N_{neg} represent the number of positive and negative samples in the test set, respectively.

Instead of determining the correctness of the suggested approach, the experiment's goal is to assess how interpretable it is. Therefore, this paper assumes that the actual employment units of students are the units recommended by the method; that is, the samples of the actual employment units of students within the TOP10 of the recommended list are retai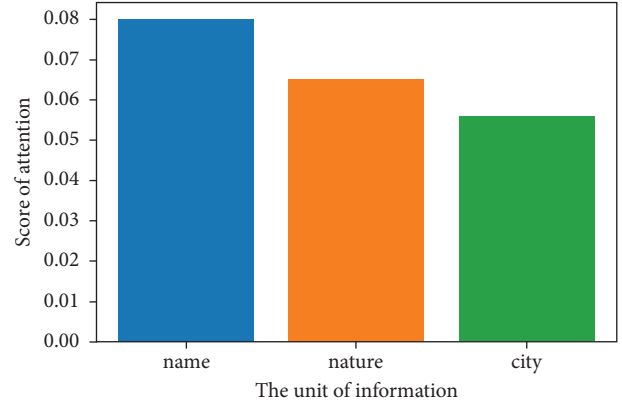ned. According to this rule, 50 students from the test set are randomly selected as experimental subjects. For each student, the proposed method is used to generate recommendation explanations and randomly generate recommendation explanations. The recommended explanation information contains two modules: the explanation module based on employment characteristics outputs the characteristics of the top three students in importance score and the characteristics of the top three employment units in importance score as explanations, which are presented in the form of bar graphs, as shown in Figures 5 and 6.

A comparative experiment was carried out on the real data set EMDAU, and the experimental results verified the superiority of the career guidance system integrated with artificial intelligence and ideological and political education. In order to ensure the accuracy of the experimental results, we conducted the same experiment on the dataset for five
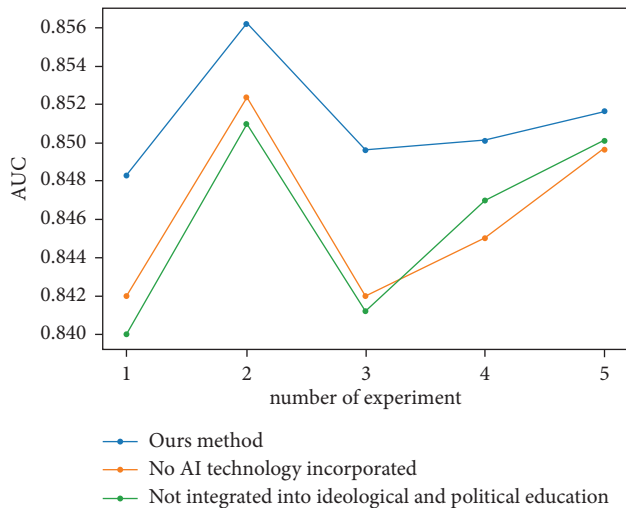
FIGURE 8: Ablation experiments.

times. Figure 7 shows that the AUC value of the proposed method is higher than that of the traditional employment guidance system, indicating that the proposed method has better performance than the traditional employment guidance system.

The experiment in this study consists of two components: ideological and political education and AI technology. In order to further verify the AI technology and the effect of ideological and political education of university students' employment play, we have done 5 times on data sets of the same ablation experiments. Figure 8 shows the effect of the fusion of artificial intelligence and ideological education in college students' employment guidance systems. According to the result, the AUC value of the guiding systems of artificial intelligence and merged ideological education of college students' employment guidance systems is high. It shows the effectiveness of the fusion method.

5. Conclusions

In this paper, a strategy that combines algorithmic recommendation with ideological and political education is used to suggest an unique career advice system for college students. In this system, we fully integrate the service function, management function, education function, and research function of students' vocational ability and employment guidance systems and add the link of ideological and political education in each process, which promotes students to form a correct employment concept. At the same time, we use recommendation algorithms in AI to make appropriate recommendations based on the capabilities and strengths that students and companies have, increasing the school's employment rate as well as student and company satisfaction. The experiments use the dataset EMDAU to verify the effectiveness of the job guidance system after integrating recommendation algorithm and ideological and political education, and they do ablation experiments to further discuss the importance of ideological and political education and the recommendation system in the work of

the job guidance system. The results show that the employment guidance system integrating ideological and political education and the recommendation system has a high AUC value. The value of AUC reflects that our proposed college student employment guidance system has a strong ranking ability, which indicates that our system can assist college students and enterprises to find suitable matches. Therefore, establishing an employment guidance system for college students that integrate AI and ideological education can effectively guide students' employment.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

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