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Research and Design of a Talent Recommendation System Based on Vocational Education

Hong Ruifeng[1], Dai Qilian[2], Pan Jun[3]

[1]Guangzhou Civil Aviation College, Guangzhou, Guangdong, China

2Guangzhou Civil Aviation College, Guangzhou, Guangdong, China

3Guangzhou Civil Aviation College, Guangzhou, Guangdong, China

[*]Corresponding author,E-mail:276712921@qq.com

Abstract

The advancement of vocational education has made it imperative to connect students with recruiting needs of enterprises in an efficient manner in order to increase employment rates and lower recruitment expenses. In order to solve problems like information asymmetry and poor matching accuracy in current talent recommendation systems, this study suggests a talent recommendation system based on vocational education. By obtaining the learning data from the vocational education stage, such as course grades, project experience, practical skills, and so on, this system creates detailed assessment information for the students. The system connects job opportunities with student assessment data based on hiring needs after receiving recruiting needs information from businesses. It then generates job matching results and suggests talent to businesses based on the matching findings. This technology can precisely determine how well vocational education students and business job openings match, actively suggest to enterprises those students who best suit their needs, lower the cost of enterprise hiring, and increase the effectiveness of talent employment.

Keywords:Talent Recommendation; Data Mining; Machine Learning; Vocational Education

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1 CURRENT STATUS OF TALENT RECOMMENDATION SYSTEMS

In China, vocational education is an essential means of developing highly qualified technical and skilled labor, which in turn supports industrial growth and job creation. There are, however, significant disparities in the supply and demand of talent due to problems like information asymmetry and poor matching degrees between students taught through vocational education and the employment needs of businesses.

1.1 Current Status of Vocational Education and Analysis of Talent Demand

China's vocational education has developed quickly in the last several years, growing in enrollment and steadily raising the caliber of talent development. The Ministry of Education reports that as of 2023, there were 8,665 vocational schools in the country. These included 1,547 higher vocational (specialized) schools, 7,085 secondary vocational schools, and 33 undergraduate-level vocational schools [1]. Vocational school graduates' employment rate has consistently been over 90%, and they are now a significant contributor to China's social and economic advancement.

However, there are still a number of obstacles facing vocational education in China:

(1)Disconnection between curriculum settings and enterprise needs: Some vocational schools' curriculums are out of step with industrial development, which causes students' knowledge to not match real-world job requirements and falls short of what businesses need in terms of highly skilled and technical workers.

(2) Poor practical instruction: Students at certain vocational institutions struggle to manage complicated job duties because they get insufficient practical instruction.

(3) Students' lack of employment competitiveness: It might be challenging for certain vocational school students to stand out in the extremely competitive labor market because they lack employment competitiveness and understanding of career planning.

However, as industries undergo restructuring, upgrading, and transformation, businesses are becoming more and more in need of highly qualified individuals with technical skills, particularly in new industries. Data from the Ministry of Human Resources and Social Security show that in the third quarter of 2022, skilled workers made up a sizable share of the 100 most in-demand occupations in terms of hiring and job searching nationally. Examples of these occupations include computer programmers, salespeople, and operators of auto assembly lines [2].

1.2 Current Research Status of Talent Recommendation Systems

Talent suggestion algorithms have been used extensively in online recruiting in recent years, with impressive outcomes. Through the use of big data and artificial intelligence technology, these systems are able to precisely match job searchers with opportunities by analyzing pertinent data from both recruitment companies and job seekers. For example, job suggestion tools on recruiting sites like Liepin and LinkedIn can provide recommendations about appropriate job openings based on the credentials of job seekers and the hiring requirements of businesses.

Though systems designed exclusively for students enrolled in vocational school are still in their infancy, the majority of talent referral systems now in use are aimed at graduates of general higher education. The following areas are the major focus of current research:

(1) Building Student Evaluation Models: Studies on the creation of rational and scientific student evaluation models that take into account a wide range of variables, including students' academic standing, project experience, practical skills, and more [3].

(2) Design of Job connecting Algorithms: Studies on the creation of effective algorithms for connecting jobs with companies that accurately fit hiring requirements based on student assessment data [4].

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(3) Talent Recommendation Algorithm Design: Studies on the creation of rational talent recommendation algorithms that suggest appropriate employment roles for learners in accordance with job matching outcomes [5].

2 KEY TECHNOLOGIES OF TALENT RECOMMENDATION SYSTEMS

Systems that recommend talent play a crucial role in bridging the gap between employers and job searchers. Their main function is to efficiently analyze large amounts of data and extract useful information in order to match job searchers and opportunities accurately. As the three main artificial intelligence technologies, data mining, machine learning, and natural language processing, they are important components of talent recommendation systems.

2.1 Data Mining Technology

Technology for data mining is the basis of talent recommendation systems. Its objective is to provide data assistance for talent recommendation by utilizing exploration and analysis to find hidden patterns and regularities in huge amounts of data. Data mining technology is primarily used in the following areas in talent recommendation systems:

(1) User Persona Construction: To comprehend job seekers' career interests, skill levels, work experience, etc., a user persona is formed by mining data such as résumé information, educational background, work experience, and talents. This serves as a foundation for talent recommendations and job matching in the future.

(2) Job Persona Construction: To understand an organization's recruiting needs, job characteristics, corporate culture, etc., a job persona is formed by mining data released by the organization, such as job listings, requirements, and corporate culture. This serves as a foundation for future talent recommendations.

(3) Abnormal Data Identification: By identifying anomalous data in resumes, such as erroneous and duplicate information, data mining technology enhances data quality and offers a solid data base for talent recommendations.

2.2 Machine Learning Technology

Talent suggestion systems are mostly powered by machine learning technology. Its goal is to precisely match job searchers with openings by extracting patterns from vast amounts of data, creating models, and making predictions and classifications. Machine learning technology is mainly used in the following areas in talent recommendation systems:

(1) Building a Student Evaluation Model: A student evaluation model that predicts students' professional capabilities and general attributes based on their academic achievement, project experience, practical skills, and other data may be built by leveraging machine learning technology. This gives a foundation for matching jobs.

(2) Design of Job Matching Algorithm: Support vector machines (SVMs) and neural networks are two examples of job matching algorithms that may be created by utilizing machine learning techniques. These algorithms determine the degree of fit between students and employment opportunities based on job profiles and student assessment data. They then filter the results based on this fit to determine which job seekers best suit the needs of businesses.

(3) Design of Talent Recommendation Algorithm: Talent recommendation systems like Content-Based Recommendation (CBR) and Collaborative Filtering (CF) may be designed thanks to machine learning technology. These algorithms make recommendations for appropriate job roles to students based on information about the jobs market, enterprise feedback, and individual preferences.

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2.3 Natural Language Processing Technology

Technology for natural language processing is a crucial component of talent recommendation systems. Through semantic analysis, important information extraction, and comprehension of natural language literature, its objective is to give semantic support for talent recommendation. Natural language processing technology is mainly used in talent referral systems for the following purposes:

(1) Extracting Resumé Information: Important details like school background, work experience, and abilities may be retrieved from resumes of job applicants by using natural language processing technology. This offers a data base for creating user profiles and matching jobs.

(2) Job Posting Analysis: Information about job needs and company culture may be extracted from job postings provided by businesses using natural language processing technologies. This serves as a foundation for developing job personas and recommending talent.

(3) content Similarity Calculation: Using natural language processing technology, it is possible to determine how similar the content is on student resumes compared to job descriptions, which may be used as a guide for matching candidates.

Talent recommendation systems heavily rely on data mining, machine learning, and natural language processing technologies. The basic technology of talent recommendation systems is made up of these three complementary technologies. Natural language processing technology gathers important information and performs semantic analysis; data mining technology offers a data basis for talent recommendation systems; and machine learning technology creates models and forecasts. Talent recommendation systems may precisely match job searchers with vacancies by utilizing these three technologies, which benefits recruitment companies as well as job seekers.

3 DESIGN OF THE TALENT RECOMMENDATION SYSTEM ARCHITECTURE BASED ON VOCATIONAL EDUCATION

The foundation of system development is the architecture of the talent recommendation system, which is based on vocational education. Its objective is to create a scalable, reliable, and effective talent recommendation platform that can provide businesses top-tier talent that matches their real needs. The following modules are part of the architecture design of the vocational education-based talent recommendation system: system interface, job matching, talent recommendation, assessment information creation, and data gathering.

3.1 Data Acquisition Module

The Data Acquisition Module functions as the system's data source, aiming to gather pertinent data from businesses and students alike in order to create a data base upon which future talent referrals may be made. The functions listed below are the main components of the Data Acquisition Module:

(1) Student Information Gathering: Use resources like online learning environments and internship administration systems to compile information on students' professional ethics, practical skills, project experience, and course grades.

(2) Enterprise Information Gathering: Utilize resources like enterprise information databases and job recruiting websites to gather information on job needs, company culture, and job advertisements from various firms.

(3) Data Cleaning and Preprocessing: To enhance data quality and lay the groundwork for further analysis and matching, do preprocessing on the gathered data, such as cleaning, deduplication, and formatting.

The data sources and the data collection process are depicted in Figure 1's data flow diagram for the data acquisition module.

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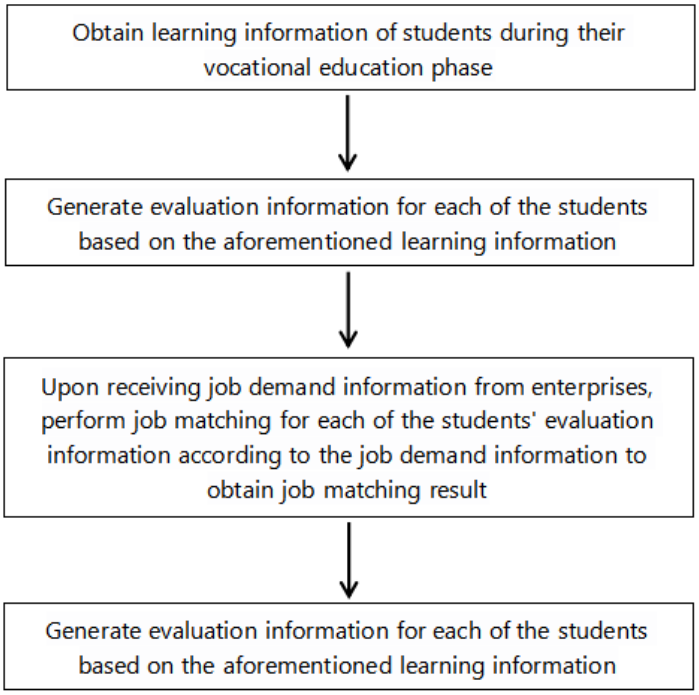

Figure 1: Data Flow Diagram of the Data Acquisition Module

3.2 Evaluation Information Generation Module

In order to evaluate students' professional abilities and general attributes, the assessment Information Generation Module's goal is to produce thorough assessment information for them based on their student data. The following are the main functions of the Evaluation Information Generation Module:

(1) Student Evaluation Model Construction: Based on academic achievement, project experience, practical skills, and other pertinent data, a student evaluation model that forecasts students' professional capabilities and overall traits is built using machine learning techniques.

(2) Construction of the assessment Indicator System: Create a rational and scientific system of assessment indicators for students that takes into account a variety of factors, including practical skills, project experience, academic achievement, and professional ethics.

(3) Update assessment Data: Update student assessment data on a regular basis to take into account advancements in both academics and careers.

The process of building the student assessment model, comprising data input, model training, and evaluation information output, is depicted in Figure 2 for the assessment Information Generation Module.

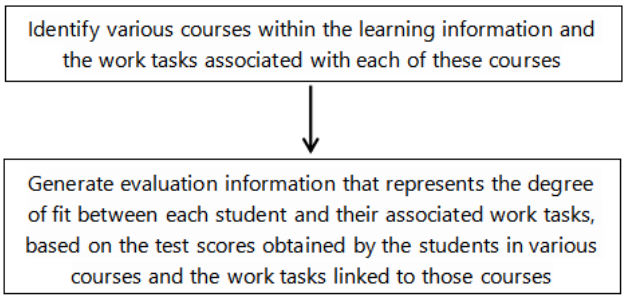

Figure 2: Data Flow Diagram of the Evaluation Information Generation Module

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3.3 Job Matching Module

The Job Matching Module's objective is to match job searchers with recruiting needs of enterprises and student assessment data exactly so that the organization may find the best applicants. The following are the main features of the Job Matching Module:

(1) Job Persona Construction: To create a job persona, use natural language processing technologies to job listings provided by businesses. Gather information about company culture, job requirements, and other pertinent details.

(2) Designing Matching Algorithms: Using machine learning technology, create job matching algorithms like Support Vector Machines (SVMs), Neural Networks, and so forth. These algorithms rank the results and determine which candidates are best suited for the company by calculating the degree of match between students and jobs based on job personas and student evaluation data.

(3) Analysis of Matching outcomes: Examine the matching outcomes to pinpoint important variables impacting the efficiency of the matching process and iteratively refine the matching algorithm.

The Job Matching Module is depicted in Figure 3, which also shows the work task analysis, requirement item identification, and matching algorithm design stages of the algorithm's design process.

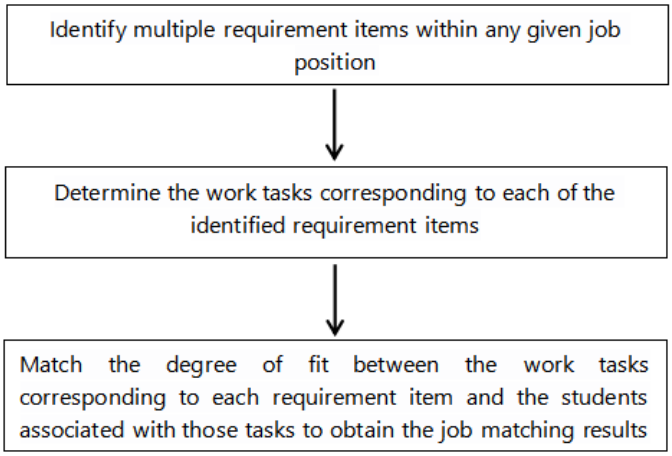

Figure 3: Design Process of the Job Matching Algorithm

3.4 Talent Recommendation Module

The Talent Recommendation Module's objective is to assist students in finding the best jobs by making recommendations for appropriate work openings based on job matching findings. The following features are principally included in the Talent Recommendation Module:

(1) Recommendation Algorithm Design: Make recommendations to students about appropriate job positions based on their preferences, enterprise feedback, employment market data, and other factors by using machine learning technology to design talent recommendation algorithms, such as collaborative filtering algorithms, content-based recommendation algorithms, etc.

(2) Recommendation Result Display: Give students an easy-to-understand presentation of the recommendation results together with pertinent employment details like business profiles, job duties, pay and perks, etc.

(3) Assessment of Recommendation Effectiveness: Monitor and assess the suggestions' performance in terms of click-through and conversion rates, among other metrics, and make ongoing improvements to the recommendation algorithms.

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The system architecture of the Talent Recommendation Module, which includes the recommendation algorithms, recommendation result display, and other components, is shown in Figure 4.

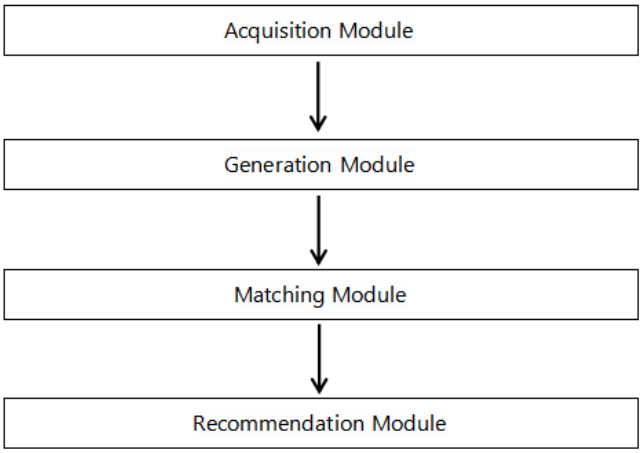

Figure 4: System Architecture of the Talent Recommendation Module

3.5 System Interaction Module

With the goal of offering a practical and user-friendly operating experience, the System Interaction Module acts as the interface between users and the talent referral system. The following are the main duties performed by the System Interaction Module:

(1) User Interface Design: Create an intuitive, visually appealing, and user-friendly user interface to make tasks easier for users.

(2) Information Query Function: To help users find relevant information, provide features for querying student, enterprise, employment position, and other types of information.

(3) User Feedback Function: Provide a user feedback function to collect users' opinions and suggestions on the system, continuously optimizing system functions.

In order to provide businesses with high-quality talent that matches their real needs, the architecture of the talent recommendation system based on vocational education must carefully take into account a number of factors, including data collection, the creation of evaluation information, job matching, talent recommendation, and system interaction.

4 CONCLUSION

In order to solve the problems of information asymmetry and low matching degrees between the job demands of vocational education students and firms, this research investigates a talent referral system based on vocational education. Precise matching between students and employment openings is achieved by the development of a talent suggestion algorithm, job matching algorithm, and student assessment model. This provides organizations with high-quality talent that matches their real needs. Vocational education-based talent recommendation systems are a complicated and ever-evolving area. Further investigation into areas like enhanced data quality, innovative algorithm optimization, system scalability, personalized recommendations, and multidimensional evaluations can further improve the efficacy and performance of talent recommendation systems, supply businesses with more high-caliber talent that matches their real needs, and support the integrated growth of China's industry and vocational education.

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