BASED ON THE APPLICATION OF AI TECHNOLOGY IN RESUME ANALYSIS AND JOB RECOMMENDATION

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ABSTRACT

This study adopted machine learning- and text mining technology-based artificial intelligence and current big data technology to analyze the trendiness of online discussion. Developing a system that can be applied in large job fairs, where numerous job applicants seek to match with the maximum of job vacancies provided by companies possible. The developed system conducts personal competitiveness analysis, personality trait analysis, and gives job vacancy recommendations according to the electronic resumes job applicants submit. In addition, the system generates a talent recommendation list for the companies. The experimental results verified that the job vacancies recommended by the developed system desirably met job applicants' expectation.

Keywords: Artificial Intelligence, Text Mining, Recommendation System, Data Analysis.

I.   INTRODUCTION

During graduation season or the traditional job transition amount between the tip of the year and therefore the starting of another year, job candidates who want to advance to following stage of their career are gung ho in seeking opportunities. In giant job fairs or job-matching events, varied businesses are usually invited, and every tends to produce numerous job vacancies to recruit ideal job applicants. within the method of job seeking, job applicants could encounter dissimilar situations: 1. they're unable to comprehensively review the content and necessities of every job vacancy attributable to the excessive amount of job vacancies provided in aforementioned occasions; 2. they do not understand their own conditions and competencies; and 3.whether or not they're admitted to the next-stage interview once undergoing the initial interview on website depends on their compatibility (based on varied indicators resembling experience, skills, .and personal characteristics) with the requirements and nature of the job vacancy they apply for. According to a survey report conducted by Glassdoor in 2015, approximately 80% of millennial job applicants check whether or not the culture of the company they intend to apply to suits them before even evaluating the event potential of the corporate [1]. This more accentuates the importance of understanding the aforesaid job needs and company culture.

The aforementioned situation is also reflected in companies' talent recruitment process. Glassdoor's 2015 survey report indicated that during the peak time of talent recruitment, a job vacancy in a large company generally receives 250 applications [1], and a job vacancy in a small-to-medium size company receives dozens of the resumes per day. the height time for job seeking is that the moment for job candidates to demonstrate their skills and distinguish themselves from varied competitors. within the meantime, it conjointly poses a challenge to job recruiters who ought to establish appropriate skills from a ocean of applicants. Several problematic situations might occur in companies during that process. When receiving a {considerable} variety of resumes, human resources (HR) personnel generally conduct a primary spherical of filter supported education associate degreed work experience, victimisation their subjective opinion to pick the abilities they consider slot in an pseudoscientific manner. In addition, a study discovered that hour personnel spends on the average half dozen seconds solely reading a resume [2]. In the peak stage of resume submission, HR personnel has to spend considerable time and effort reading resumes and is therefore likely to make hasty judgements.. In sum, a way to effectively determine appropriate candidates from a ocean of applicants and invite them to interview is often a challenge for companies.

Along with the prevalence of computing (AI) technology, repetitive tasks became attention of development for the technology. The international research and consulting agency Gartner indicated that by 2020, 1.8 million jobs will be filled by AI, but another 2.3 million job opportunities will be created, leading to a positive growth of overall job opportunities [3]. Applications of AI technology- based HR matching

have gradually attracted public attention and are becoming trendy. Similar to previous trends of state and task transformation brought by key innovations within the past, AI is making a lot of hi-tech and social control positions whereas commutation variant low-to-middle rank positions and even creating entrance-level and low-tech positions of a unique nature [4].

Considering the disadvantages observed by both the talent- recruiting and job-seeking parties, the relatively insufficient research on talent recommendation and Chinese resume analysis, and the maturation of AI technologies, thisstudy designed a resume analysis and position recommendation system, that includes a resume designation function. The designation operate performs machine learning and text mining on the electronic resume uploaded by the user to produce a personalised resume analysis on themes such fight in 3 indicators and personality traits. It allows job candidates to know their own aggressiveness on the market and eventuallyproduces a listing of counseled job vacancies on the premise of the content within the job applicant's resume. This study also designed a system for the talent- recruiting service in companies. Information technology presently is the first focus among trade types.. The system generates a talent recommendation list from the electronic resumes submitted by job applicants and analyzes each job applicant's resume. The analysis results of the job- seeking parties and companies are immediately summarized in reports and presented as charts to provide both parties a reference in jobfairs.

Through the designed recommendation system, this study expects to effectively save time and effort to both the job- seeking and talent-recruiting parties as well as to overcome time and space constraints by using the Internet. In addition, this irrationalfiltering of resumes is probably going to be avoided. The systemis predicted to function a reference for position matching to reinforce its success rate, which might be dependent for each parties.

Chapter II is an summary of the applying of current recommendation systems, clarification of the terms utilized in matter analysis and relevant applications, and application of knowledge analysis in an exceedingly personalised analysis. Chapter III is an overview of the system focusing on system functions, architecture, and process and its interface specific design. Chapter IV describes the surroundings for and results of system development.. Chapter V presents the experimental results.

II.   RELATED WORK

A. Recommendation system

Ordinary recommendation systems include a personalized recommendation function. A study [5] even highlighted the effectiveness of the personalized function in job seeking and claimed the feasibility of creating a personalized position recommendation list based on the personal preferences of job applicants.

Position recommendation has attracted the interest of diverse students functioning on recommendation systems in recent years. A study [6] listed the recommendation methods most commonly adopted by researchers as follows: content-based recommendation, collaborative filtering, and hybrid recommendation. Content-based recommendation primarily takes under consideration the connectedness and similarity ofthe text while not considering user behavior. Collaborative filtering identifies users with similar behaviors or in favor of thesame type of content on the basis of user behavior. Hybrid recommendation may be a combination of the 2 same methods. Another study [7] planned a cooperative filtering recommendation algorithm, that extends and adapts the mathematician distance idea to fulfill the challenge of matching individuals and jobs. The proposed 4 dimensions advice set of rules quantifies the suitability of the task applicant for the task role in a extra bendy manner, the usage of a dependent shape of task vacancies and the candidates' profiles, that are derived fromthe evaluation of unstructured content material of task applications.

Textual analysis

In terms of tongue methoding, matter analysis may be a refined method to process papers in any field, no matter its application to topic prediction, paper clustering, or keywordextraction. A paper [8] planned a way to resolve the similarity issue between documents and to get documents supported content similarity. associate degree formula victimization information and group efforts was adopted to calculate document similarity, not solely on the premise of grammar similarity however conjointly abstract similarity. Zhang and Gu [9] investigated text classification by using the word vector generated from the word breaker in Chinese, and that

they performed corpus coaching and prediction through machine learning, therefore effectively fulfilling their goal of serving to native folks with disabilities to seek out a job.

C. Data analysis

Under the present context wherever huge information analysis is being wide applied, the conclusion of customized data has become a trend. A study [10] claimed that internal traits and soft power are useful to roaringmen development.After quantifying personal data, the study determined

that individuals' development in a field could be improved through numerous academic and coaching programs, that ought to rework theminto outstanding talents.

III.   RESEARCH METHOD

The framework of the system developed in the present study can be explained in two parts, namely from the perspective of the job applicant(Fig. 1) and that of the job recruiter (Fig. 2).
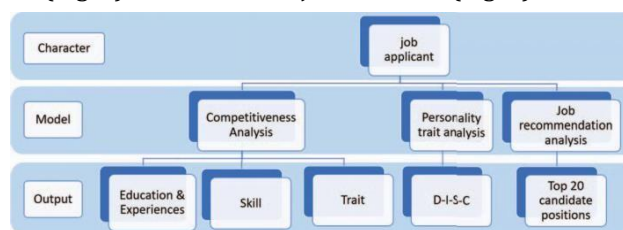

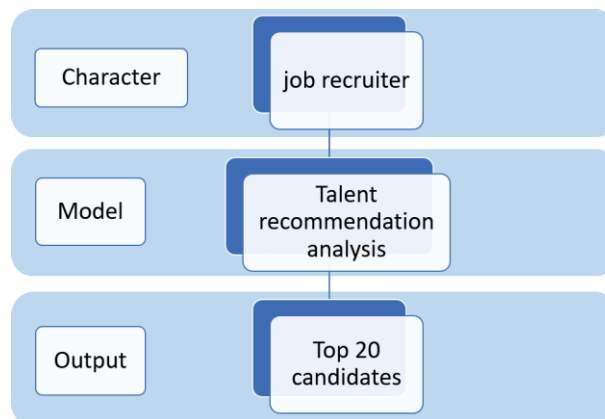**Fig. 1.** Job recommendation system framework

Fig. 2. Talent recommendation system framework

The job applicant end of the job recommendation system framework comprised three modules, namely competitivenessanalysis, personality trait analysis, and job recommendation analysis.

A.   Competitiveness Analysis

This study divided info technology into 5 areas as follows: sensible content, AI, smart networking, IP and information analysis, and internet services or E-commerce. Subsequently, the task candidates' fight in these 5 areas in terms of education and experience, skills, and temperament traits was analyzed, enabling the job applicants to higher perceive their strengths and weaknessesin these five areas.

B.   Personality trait analysis

This study conducted a personality analysis using a DISC plane, which was divided into quadrants namely dominance (D), influence (I), steadiness (S), and compliance (C). These criteria were wont to categorise the respondents' soft power in their temperament traits..

C.   Job recommendation analysis

This part of the analysis focused on matching 179 job vacancies provided in a job fair with the electronic resumes of job applicants. Subsequently, prime twenty vacancies determined by the system victimisation Associate in Nursing algorithmic rule were counseled to the duty applicant.

The job recruiter end featured a talent recommendation analysis module. The module additionally matched the electronic resumes job candidates submitted with the duty vacancies provided by job recruiters and counseled

the highest twenty candidates to job recruiters once collecting the somebodys' resumes exploitation constant algorithmic programadopted within the job applicant end.

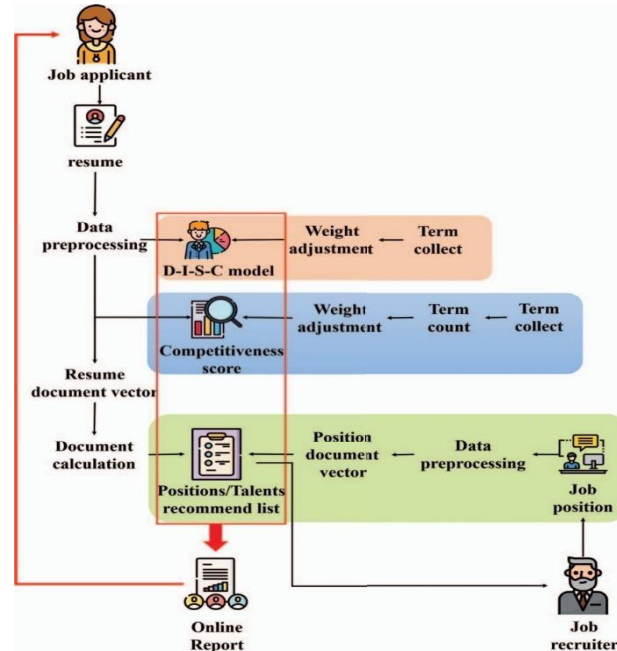Fig. 3 presents the flow chart of the developed system, whichcan be explained in the following four parts:

Fig. 3. System flow chart

DISC Model

Before partaking within the calculation of DISC temperament traits extracted from the work applicants' resumes, the researchers preprocessed the data, that consisted in breaking the Chinese words in the documentsand filtering meaningless words. Subsequently, they collected all words with the characteristics of D, I, S, and C to spot all such words from the duty applicants' resumes, performed the computing, andeventually obtained the corresponding share of D, I, S, and C within the resumes..

A. Competitiveness Score

The job applicants' competitiveness score was subsequently obtained. First, the researchers wrote a Web crawler to collect research-and-development job vacancies of information technology falling in the five categories classified in this study from online Taiwanese HR agency platforms. These job vacancies later served as the vocabulary source for the calculation of the competitiveness scores. The vocabularyof each type was further grouped under three indices, namely education and experience, skills, and personality traits (Fig. 4). Word frequency for these indices in all categories was calculatedusing a formal equation (1), which enabled the statistics in the model to converge, and the weight of each word in a specific type to be determined.

$$1 + \frac{(x - \min(x)) \cdot 9}{Max(x) - \min(x)} \tag{1}$$

The operation was conducted by subtracting each minimum value in a row from each value in the row, multiplying the value obtained by 9, dividing the obtained value by the difference between the maximum and the minimum value in the row, and adding 1 to the value thus obtained. A new row ofnumerals between 1 and 10 was obtained, with every one of these eigenvalues falling into the same scale. Eventually, the preprocessed resumes were matched with these keywords and the percentage score of each index in each category was calculated.

B. Position/Talent recommends

This study used a content-based recommendation method, which required preprocessing of the resume and job vacancy data; that is, to segment words in the documents using the Jieba kit and a self-developed dictionary and to filter meaningless words. The subsequent steps are detailed as follows: 1) term

frequency matrix, 2) document vector, and 3) similarity calculation.

Term frequency matrix: After the completion of data preprocessing in the documents, the weight of the terms is generally considered. The weight typically relates to the frequency at which a term appears in a document, which is referred to as term frequency. These terms correspond to keywords in the document. CountVectorizer was adopted in this study because the terms that appear in resumes and job vacancy descriptions are typically special terms used only in certain professional fields. Term frequency calculation was therefore appropriate. CountVectorizer is a method that calculates the term frequencies of each document and convertsthe terms into a mathematical matrix. That is, it converts the terms ina document into a term frequency matrix after which, document vector can be calculated.

Document Vector: However, terms such as "name" and "grade"may not be crucial in the value diagnosis of resumes, even if they exhibit high frequencies. Therefore, term frequency–inverse document frequency (TF–IDF) was adopted in this study to revise document vectorization. This method is term-calculation-based and is commonly used to evaluate the importance of a term in a corpus or a file set. TF–IDF is a combination of TF and IDF.

TF means the higher term frequency is, the more importantthis term is to the file; that is, the normalization of term frequency. Forexample, Eq. (2) calculates the ratio of the frequency of Term i in File j to the number of all terms in File j.

$$tf_{ij} = \frac{n_{ij}}{\sum_k n_{kj}} \qquad (2)$$

IDF assesses the importance of a specific term to the whole file and is obtained by calculating the ratio of the number of files in the Master File Set |D| and Term i taking the logarithm of the value, which is obtained with a base number of 10 (Eq. 3).

TF–IDF multiplies TF with IDF and is used to evaluate theimportance of a specific term in a file set or one of the files in a corpus. Term importance increases with its frequency in a file but decreases when its frequency increases in the corpus.

Similarity Calculation: After the document vector is obtained, the next step is to determine the correlation or similarity betweenjob applicants' resumes and companies' job vacancies. The more similar the characteristics of two events are, the smaller the distance obtained between the twois, and vice versa. This study used cosine similarity to calculate the cosine value of the included angle and to determine the difference between two vectors (Eq. 4). Cosinevalues range between −1 and 1; the closer they are to 1, the closer the included angle is to 0°, demonstrating a high

similarity between the two vectors. Conversely, the closer the cosine value is to −1, the closer the included angle is to 180°, indicating a smaller similarity between the two vectors.

$$\cos\theta = \frac{\vec{x} \cdot \vec{y}}{\|x\| \cdot \|y\|} \qquad (4)$$

C. Online Report

This study eventually generated a real-time online report. On the job applicant end, the report indicates the analysis results of the individual's resume, which is visualized by charts of personality trait analysis, competitiveness analysis, and job recommendation analysis (Fig. 4). On the company end, only a talent recommendation list is displayed.
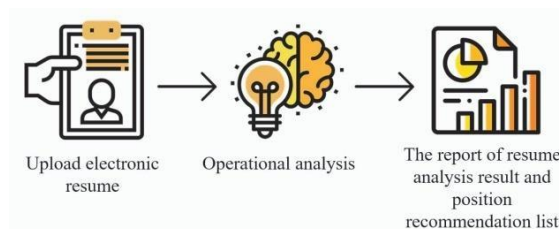
Fig. 4. Output of online report

$$\bar{i}df_i = \log\left(\frac{|D|}{1+|D_i|}\right) \qquad (3)$$

Fig. 5 presents the user–job applicant flow chart. Job applicants simply need to upload their electronic resume to have their resume evaluated using the logic operation developed in this study. Finally, analysis results and a jobvacancy recommendation list are generated.

Fig. 5. The user flow chart of job applicant

The user–job recruiter flow chart (Fig. 6) illustrates that thesystem can compile all resumes submitted for a job vacancy provided by a job recruiter and produce a talentrecommendation list through the designed logic operation. Jobrecruiters can subsequently select their ideal candidates from the list.
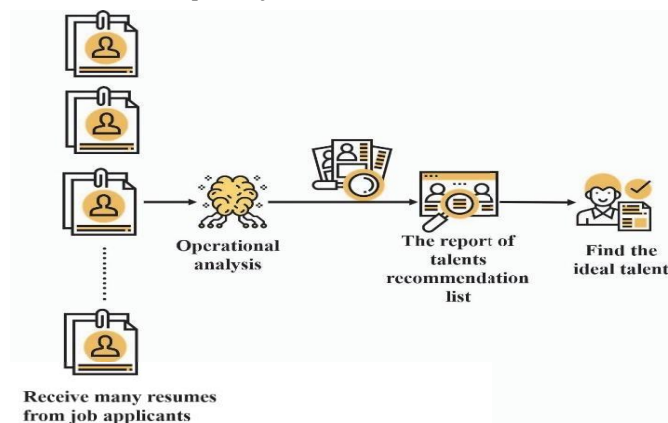
Fig. 6. The user flow chart of recruiter

IV.   RESEARCH RESULT

The analysis of the duty vacancy recommendation results on the job person finish was conducted through a form survey. The questionnaire was designed using a Likert scale for the respondents to provide their level of agreement with each item. On the five-point Likert scale, 5 indicated complete agreement, four indicated agreement, three indicated neutral opinion,

The recommendation system form comprised 5 things as follows: 1. Have you known job vacancies of interest to you once victimization this job vacancy recommendation system?2. Have you benefitted from mistreatment this job vacancy recommendation system? 3. have you ever received Associate in Nursing interview notice for any job vacancy counseled by this system? 4. Are you satisfied with the accuracy of this system? 5. Would you recommend this system to others?

This form was administered to forty respondents, and every one 40 copies were comeed, yielding a return rate of 100%. The total average score was 3.39. Specifically, the score for Item a pair of reached 3.5, suggesting that the advice results of the system effectively motor-assisted job candidates within the job seeking process. The average scores for things one and three were comparatively low (3.33), indicating that though the advice results effectively helped job candidates realize their career direction, the task vacancies suggested weren't essentially ideal for the job applicants. The statistics from the survey findings are shown in Table 1.

Table 1. Job Recommendation System Questionnaire Statistics Results

	1	2	3	4	5
1. Have you identified job vacancies of interest to you when using this job vacancy recommendation system?	1	5	18	12	4
2. Have you benefitted from using this job vacancy recommendation system?	1	4	14	16	5
3. Have you received an interview notice for any job vacancy recommended by this system?	1	6	16	13	4
4.Are you satisfied with the accuracy of this system?	0	6	16	14	4
5.Would you recommend this system to others?	0	4	20	13	3

V.   CONCLUSION

The job vacancy recommendation system designed for job applicants in this study relies on resume analysis. The analysis results comprise a aggressiveness score (based on education and experience, skills, and temperament traits), DISC personality and ability analysis, and job vacancy recommendations. All these aim to function a basis for the task applicants' self- understanding and evaluation, to help them find employment seeking direction among the various job vacancies provided in large-scale interview events, and even to alter them to spot the foremost appropriate job vacancies for them at the moment. The system obtained satisfactory performance within the analysis by the work candidates. For companies, a talent recommendation system was designed to help job recruiters understanding user conditions and to function a tool within the choice and analysis of prospective employees. However, during this study, job vacancy recommendation was conducted per job applicants' resumes. Considering that a number of these candidates can be seeking a career transition, it's doable that it created their current goal inconsistent with their previous expertise or skills. Therefore, the recommendation results might not have met the needs of every job applicant.

In future studies, the accuracy of the recommendation model should be enhanced, and keywords that commonly appear in job vacancy descriptions should be scored and adopted as reference for weighting, so that the system achieves the performance expected by companies Furthermore, the system might extract the duty title from the vacancies that job candidates like or the abilities they need mastered, in order that their resumes become even a lot of compatible with their ideal companies, which the demand for personalised services for each parties may be improved. This study only investigated the feedback of job applicants who used the job vacancy recommendation system. No questionnaire survey regarding the

talent recommendation system designed for companies was conducted. To enhance the accuracy of the system's recommendation results, researchers will explore comprehensive the acceptance rate of job candidates once their interview. That is, the particular variety of job vacancies that were originally on the advice list and later crammed by the candidates ought to be evaluated. In addition to job vacancy and talent recommendation, the designed system are often introduced in different areas comparable to teaching, attire industry, and hairdressing for a wider application.

ACKNOWLEDGEMENT

VI.   REFERENCES

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