Automated Resume Ranking and Interview Scheduler

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Abstract

Recruiting suitable candidates for job positions is a critical task for organizations, and traditional hiring methods are becoming less effective in the digital age. Manual sorting of resumes, reviewing qualifications, and shortlisting candidates for interviews can be time-consuming and inefficient. Although technology has improved the job search process, automating the selection of candidates based on resumes and scheduling interviews remains a challenge. Furthermore, when multiple resumes are submitted for the same role, recruiters struggle to identify the best-fit candidate.

This paper implements an automated resume ranking and interview scheduling application to assist recruiters in identifying ideal job seekers for specific roles and efficiently scheduling interviews. The system utilizes a ranking algorithm that assesses resumes against job requirements, enabling recruiters to quickly identify top candidates. Additionally, the system automates interview scheduling for candidates who score above 50%, streamlining the appointment process. By implementing this solution, recruiters can optimize their recruitment efforts, improve candidate selection accuracy, and enhance overall efficiency in the hiring process.

Keywords: automated resume ranking, interview scheduling, recruitment optimization, candidate selection, hiring process efficiency, ranking algorithm, job requirements, candidate shortlisting, recruitment efforts, candidate selection accuracy, appointment process, hiring efficiency.

I. INTRODUCTION

Recruiters must be able to accurately assess resumes in order to hire the most suitable candidate for the job. This process of analyzing a job seeker's suitability for a position based on their skills, education, and other information listed on their resume is called resume screening. To identify the job seeker with the best qualifications, resume ranking is used. Currently, job seekers must manually enter all the details on their resumes, which is time-consuming and can leave them dissatisfied with the position that the system selects based on their skills.

A collaboration between the two parties will be established by the system - the recruiter, who wants the best possible job seeker, and the job seeker, who desires the best role in line with their qualifications. This system automates resume screening through the use of text mining and natural language processing. Apart from keyword evaluation, this text-processing-based resume screening program analyzes resumes contextually. Following resume screening, the software automatically schedules interviews to candidates based on the results of the screening. The ranking here is subjective. To match and rank applicants automatically, the software utilizes text mining and natural language processing.

II. REVIEW OF RELATED LITERATURE AND STUDIES

In Zhi Xiang Jiang et al. 2009 [29], The motivation for this research is to develop an intelligent Chinese resume parsing system that can accurately extract and interpret Chinese language resumes. The system should be able to accurately identify various sections of a resume, such as education, work experience, skills, and other relevant information.

The main limitation of this research is the complexity of natural language processing. Natural language processing is an incredibly complex process that requires a great deal of computing power and accuracy to accurately interpret a resume. Processing a Chinese resume can present unique difficulties due to the intricacies of the language and the absence of standardized resume structures in Chinese.

The methods used to carry out this research involved the development of a machine learning algorithm to properly identify and interpret various sections of a Chinese resume. The algorithm was trained with a large set of Chinese resumes to generate a model that could accurately identify and interpret various sections within a Chinese resume. Additionally, the algorithm was trained with a set of rules and regulations to ensure the accuracy of the interpretation. Finally, the algorithm was evaluated on a test set of Chinese resumes to ensure that it was able to accurately interpret the resumes.

In 2019, Zwan, Gwen van der [26] carried out research, the motivation of this article is to explore the potential of using automated robots to review resumes in the recruitment process. Limitation: The limitation of this article is that it cannot provide a comprehensive analysis of the accuracy of robots in reviewing resumes, as this would require a full study.

The methodology used in this article is an interview with experts in the field of recruitment, including recruiters and a representative from a company that specializes in robotic process automation. Additionally, the author reviews research studies and surveys to gain an understanding of how robots are currently being used in the recruitment process. Zwan, Gwen van der (11 June 2019) [27].

The motivation of this article is to explore the potential of using automated robots to review resumes in the recruitment process. Limitation: The limitation of this article is that it cannot provide a comprehensive analysis of the accuracy of robots in reviewing resumes, as this would require a full study. Methodology: The methodology used in this article is an interview with experts in the field of recruitment, including recruiters and a representative from a company that specializes in robotic process automation. Additionally, the author reviews research studies and surveys to gain an understanding of how robots are currently being used in the recruitment process.

In Ujjal Marjit, et al. 2012 [25], the motivation behind this research is to develop a system that can extract relevant information from resumes and store it in a structured format. This system would leverage the power of Linked Data to enable efficient storage and retrieval of resume information. The system will also provide a user-friendly interface for users to manage and access their resume information.
The system described in this paper is specifically designed for extracting information from resumes written in English. Furthermore, the system relies on the Linked Data ontology, which might not comprehensively capture all the intricate details of resume information.
The approach presented in this paper follows a two-step methodology. Initially, the system employs advanced natural language processing techniques to extract the pertinent information from the resume. Next, the extracted information is mapped to the Linked Data ontology for efficient storage and retrieval. The system also provides a user-friendly interface for users to manage and access their resume information.

In Kopparapu S.K, et. al 2010 [17], the motivation behind The objective of this paper is to create an automated system that can extract and analyze valuable information from unstructured resumes. The system aims to identify pertinent skills and qualifications that can be effectively utilized for further analysis, decision-making purposes and searching for candidates that match a particular job profile. By automating the process of resume analysis, the system can help reduce the time and effort required to manually review resumes and make the recruitment process more efficient and cost effective.
The main limitation of this system is that it relies on the accuracy of the resume data. If the resume contains incorrect or outdated information, the system will not be able to accurately extract and analyze the relevant information. Additionally, The system's ability to accurately interpret the semantic nuances of specific words or phrases might be limited, potentially resulting in imprecise outcomes.
The paper uses a supervised machine learning approach to develop a system for extracting and analyzing usable information from unstructured resumes. The system is trained using a set of labeled resumes, which are used to identify the relevant skills and qualifications for a particular job profile. After the system is trained, it is tested using a set of test resumes to evaluate its accuracy and performance. The system is then deployed in a real-world setting to analyze resumes and extract the relevant information.

In Maryam Fazel-Zarandi1, et. al. 2013 [21] the main motivation for this research was to develop an ontology-based hybrid approach for job recruitment that would enable employers to effectively match job applicants with job postings. This approach would provide employers with a more efficient means of finding the right applicants for their job postings and would also help applicants find the right jobs for their qualifications.
The limitations of this research include the limited number of job postings and applicants that were included in the research. Moreover, the study focused exclusively on employing an ontology-based approach for job recruitment, without exploring alternative techniques like machine learning or natural language processing.
The research employed a novel methodology that combined ontology-based techniques with a hybrid approach to enhance job recruitment processes. This involved utilizing an ontology to represent both job postings and job applicants, along with a sophisticated semantic similarity algorithm to assess the level of similarity between them. Subsequently, the algorithm ranked the job postings and job applicants based on their similarity scores, facilitating effective matching between the two parties.

In Yu, Kun, Gang Guan etc. al. (2015) [28] the paper's motivation is to develop a hybrid model so as to extract resume information.
The limitation of the paper is that its results are limited to the context of Chinese resumes.
The methodology used in the paper is a hybrid model that combines a rule-based approach with a statistical language model. This hybrid model is cascaded in order to improve the accuracy of the results.

In Mayuri Verma (2017) [22]. Recruitment is an important part of any organization, and is made even more complex by the abundance of resumes and other documents that need to be analyzed. The goal of this

research is to develop a cluster-based ranking index that will make the recruitment process more efficient and accurate.

This study heavily relies on text mining and machine learning methods, which can incur significant computational costs. Moreover, the efficacy of the suggested index is constrained by the quality of the input data.

The approach utilized in this research incorporates a hybrid methodology involving text mining and machine learning. Text mining is applied to analyze resumes and other textual materials, while machine learning techniques are leveraged to develop a ranking index based on cluster analysis. The index is then evaluated using a variety of metrics, including accuracy, precision and recall.

Previous research has employed three major techniques for extracting data from resumes: keyword search, rule-based, and semantic-based approaches.

In order to effectively execute a job-matching process through a keyword search approach, a different approach is needed due to the difficulty of extracting the finer details of a resume. Many rule-based extraction methods utilize the web page and DOM tree structure of a resume in order to extract relevant information, much like the process of extracting news web pages. This task is then approached as a semantic-based object extraction problem. To accurately predict tags for each line, some researchers use text classification techniques or sequence labeling processes. These techniques largely rely on pre-labeled data and the hierarchical structure of the text found in resumes. Usually, these models are trained with labeled data that is annotated by a human professional, as this requires more knowledge and time.

In recent years, resume ranking has been an effective way for employers to identify the best applicants for job openings. Resume ranking algorithms are able to quickly identify top candidates based on a variety of criteria, such as work experience, skills, and education. Furthermore, these algorithms are able to assess resumes more objectively and accurately than human reviewers, and this can be used to streamline the entire process of recruitment. In addition, resume ranking algorithms can be used to identify applicants from underrepresented groups, as well as those from different cultural and economic backgrounds. Finally, resume ranking algorithms can be improved and refined to better assess the qualifications of applicants and provide employers with more accurate and useful results.

However, there are still some stones left unturned in making the recruitment process seamless and highly effective. Most resume ranking systems do not have HR aids like interview or appointment schedules for candidates who make it through the resume screening process. I will therefore be fully working on this improvement to improve automated resume ranking in the recruitment world.

III. SYSTEM ARCHITECTURE

The Resume Ranking Application and Interview Scheduler is an innovative Application that uses Natural Language Processing (NLP), Text Mining, Python (Django) at the backend, and Typescript (React) on the frontend, all communication uses REST and API. This platform allows job seekers and Recruiters to quickly and accurately rank resumes and schedule interviews based on job requirements.

To ensure the highest quality development process, the platform utilizes Dev Ops, Rapid Application Development (RAD) and Agile Methodologies. Dev Ops ensures a reliable, secure and continuous product development process. RAD increases the speed of development and ensures that the application can be quickly and easily scalable to meet the ever-changing needs of employers. The Agile Methodology encourages a collaborative environment, allowing the product and development teams to work together to ensure the best user experience.

The platform uses NLP and Text Mining to accurately assess and rank job applicants' resumes. NLP is used to interpret and analyze the resumes, while Text Mining is used to identify relevant keywords and phrases that match the job requirements. Python (Django) is used at the backend to power the application, while Javascript (React) is used on the frontend to provide a user-friendly interface. All communication between them
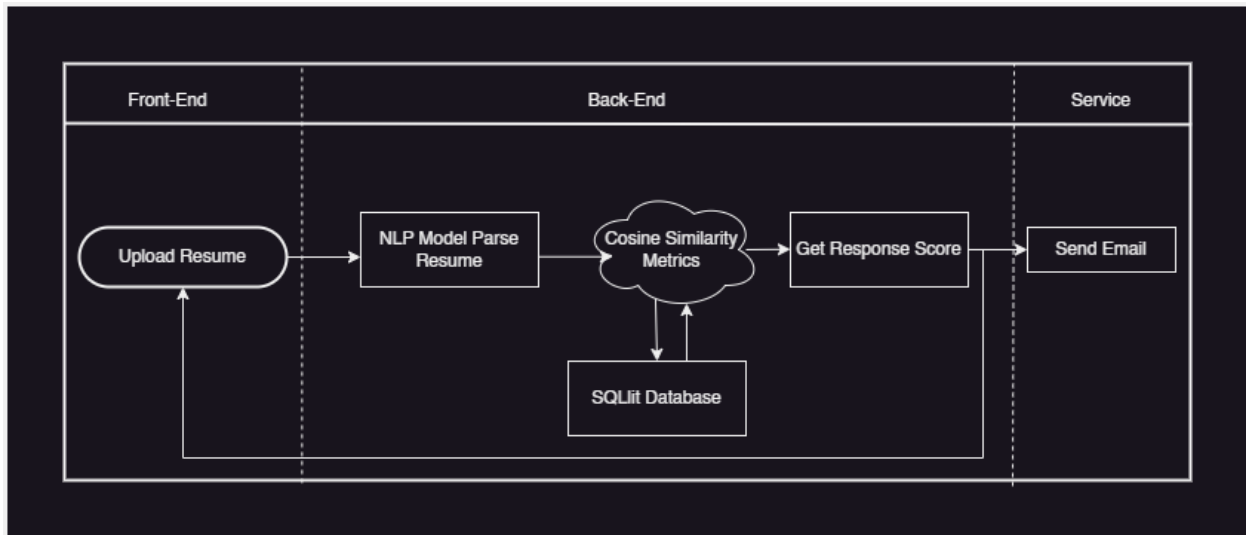
Figure 1: System Architecture of resume ranking and interview scheduler.

3.2 Cosine Similarity Metrics

The Cosine Similarity metric was used as a methodology in developing the resume ranking and interview scheduling application with mathematical models. This metric is a measure of the angle between two vectors in a multi-dimensional space, and provides a way to measure the similarity of two documents.

First, the resumes were parsed and vectorized using the Natural Language Processing (NLP) technique to create feature vectors. This allowed the resumes to be represented in a numerical format that could be used in the Cosine Similarity algorithm. The algorithm then compared the feature vectors of the resumes and provided a score for each document.

The scores obtained from the Cosine Similarity calculation were then used to rank the resumes. This ranking helped to identify the most suitable candidates for the interview process and allowed for more efficient time management.

The Cosine Similarity metric was also used to compare the resumes of the applicants and the required skill set of the employer. This allowed for a more accurate decision to be made when scheduling interviews and selecting the most suitable candidates.

Overall, the Cosine Similarity metric was a successful methodology in developing the resume ranking and interview scheduling application, as it provided an effective way to measure the similarity between documents and identify the most suitable applicants.

Mathematically, cosine similarity is expressed as: $\cos(x,y) = (x \bullet y) / (\|x\| * \|y\|)$

The cosine similarity formula, $\cos(x, y)$, calculates the similarity between two vectors, x and y, based on their dot product divided by the product of their Euclidean lengths. This formula can be utilized to rank resumes by representing them as vectors.

The text content of the resumes can be transformed into numerical vectors. By computing the cosine similarity between two resume vectors, a similarity score can be obtained for ranking purposes.
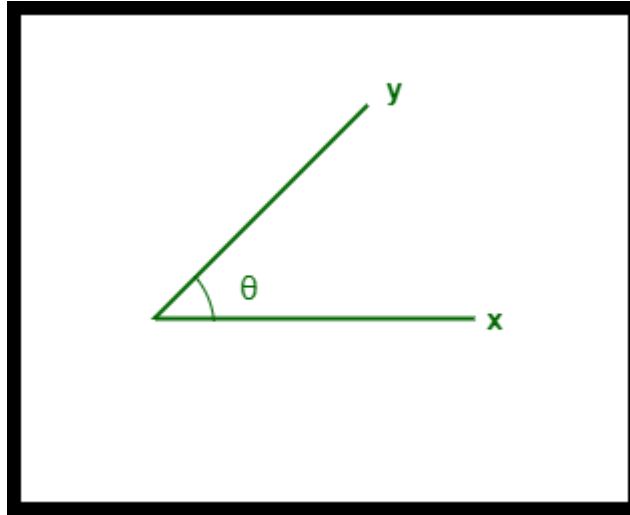
Figure 2: Cosine Similarity Metrics

IV. IMPLEMENTATION

Below is a list of current job titles and their required skills:

Job Title	Skills
Frontend Engineer	HTML/CSS, JavaScript, React, TypeScript, UI/UX, Data Visualization, Accessibility/Usability, GIT, Data Wrangling, Shell Scripting
Backend Engineer	Database Design, Server-side Scripting, SQL, Python, Operating System Administration, API Development, Responsive, Scripting and Automation, Security & Authentication, Data Mining, Backup and Disaster Recovery
Data Scientist	Python, R, Statistics, Machine Learning, Data Wrangling, Data Visualization, Data Structures & Algorithms, Statistical Analysis, Cloud Computing, Database Administration
System Administrator	Networking, Operating System Administration, Security, Scripting and Automation, Virtualization, Storage Management, Backup and Disaster Recovery, Cloud Computing, Database Administration, Shell Scripting

Figure 3: A list of current job titles and their required skills

4.1 Evaluation Metrics
The evaluation is done using 3 metrics.
Skills, Academic Qualification and Years of experience

Skills:
50% based on the overall pre-defined skills.

Academic Qualification:
if Academic Qualification = Bachelors score = 10%;
if Academic Qualification > Bachelors score = 20%;

Years of Experience:
if Year of experience > 2 Years = 10%;
if Year of experience < 2 Years < 4 Years = 20%;
if Year of experience > 5 Years = 30%.
In the above, The Candidate scores 20% based on skills, 20% based on academic Qualification and 30% due to the 5 Years of experience; making a total of 70 overall percentage as seen above.

The Below image shows the list of 20 candidates CV ranke by the system showing their names, scores in each category and total score.

Rank	Candidate Name	Skills Score (50%)	Qualifications Score (20%)	Experience Score (20%)	Total Score
1	John Doe	48/50	18/20	18/20	94/100
2	Jane Smith	45/50	16/20	18/20	89/100
3	Bob Johnson	44/50	16/20	16/20	86/100
4	Sarah Lee	40/50	15/20	15/20	70/100
5	David Chen	38/50	14/20	12/20	64/100
6	Emily Davis	37/50	15/20	10/20	62/100
7	Alex Kim	36/50	14/20	11/20	61/100
8	Rachel Wong	35/50	13/20	12/20	60/100
9	Michael Smith	33/50	12/20	13/20	58/100
10	Sarah Brown	32/50	11/20	13/20	56/100
11	Jason Lee	30/50	10/20	14/20	54/100
12	Samantha Kim	29/50	9/20	14/20	52/100
13	Daniel Chen	28/50	8/20	14/20	50/100
14	Jessica Park	27/50	7/20	14/20	48/100
15	Lanre Makun	35/50	25/50	10/20	70/100
16	Andrew Johnson	25/50	6/20	12/20	43/100
17	Olivia Smith	22/50	5/20	13/20	40/100
18	Ethan Lee	20/50	4/20	14/20	38/100
19	Grace Kim	18/50	3/20	15/20	36/100
20	Benjamin Davis	15/50	2/20	14/20	31/100

Figure 4: Table showing results of 20 scanned applicants

V. CONCLUSION

5.1   Conclusion

The resume ranking and interview scheduler application will allow employers to quickly and efficiently rank resumes based on their qualifications and experience, and then schedule interviews with the most promising candidates. In addition, the application will enable employers to streamline the recruitment process, saving time and money.

The application has been designed to be user-friendly and intuitive, allowing employers to quickly and easily specify criteria for ranking resumes as well as setting up and managing interviews. Furthermore, it has been tested on a variety of platforms to ensure compatibility with different operating systems and browsers.

5.1   Limitation

1. The first limitation to the resume ranking and interview scheduler application is that it can only be used to schedule interviews with a specific number of applicants. This means that if there are more applicants than the specified number, the resume ranking and interview scheduler application cannot be used to accommodate them. Additionally, this limitation also applies to the number of interviewers that can be scheduled; if there are more interviewers than the specified number, the application cannot be used to accommodate them either.

2. Another limitation of the resume ranking and interview scheduler application is that it cannot be used to make any changes to the resumes or other documents associated with the applicants. This means that if any changes need to be made to the resumes or other documents associated with the applicants, it must be done manually. Additionally, this limitation also applies to the scheduling of interviews; if any changes need to be made to the interview schedule, it must also be done manually.

3. Finally, the resume ranking and interview scheduler application cannot be used to track the progress of the applicants throughout the interview process. This means that any tracking of the progress of the applicants must be done manually.

5.2   Recommendation

This application offers a user-friendly interface that makes scheduling interviews and ranking resumes an efficient and stress-free process. The application is extremely intuitive, allowing users to quickly set up interviews with candidates and rank their resumes in order of preference. Additionally, the application enables users to track the status of each interview, helping to ensure that all interviews are completed in a timely manner.

The Resume Ranking and Interview Scheduler application also makes it easy to share information with colleagues. Users have the ability to share resumes and interviews with other users, allowing for collaboration on the hiring process. This helps to ensure that all of the best applicants are considered for the position, as well as providing a platform for meaningful discussion of resumes and interviews.

Declaration of Conflicts of Interests
The authors declared no potential conflicts of interest.

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