Enhancing Recruitment Efficiency: A Proposal for an Automated Resume Screening and Job Suggestion System on the 'Dreams Job' Online Platform

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Abstract. Both candidates and recruiters now face difficulties and uncertainty due to the growing volume and complexity of information in resumes. As they may showcase their abilities and qualities to prospective companies, resumes are vital for recruiters and students seeking employment prospects. Numerous professions are produced because of the advancement of technology, and new trends are introduced into the market daily. Before applying for a job, a candidate must know which roles are compatible with them. It can be challenging to manually determine whether a resume is a good fit for a certain job role based on reading the job description and the resume. Therefore, to solve existing issues and offer a practical platform that benefits companies and job seekers alike, it is suggested to create an online job site called "Dreams Job" with automated resume screening and a job suggestion system. Job searchers can register, apply for employment, and use advanced search features to identify positions and occupations that fit them through an online application. The application allows candidates to upload their resumes, which are saved for further use. Based on their credentials and skill set, candidates are matched with relevant opportunities by the portal's unique job suggestion algorithm. Employers can also manage and post jobs, and they can take advantage of a smooth application review procedure. The administrator manages user profiles and selects which jobs and firms are allowed to access or display on the site. Anywhere in the world, both Employers and Candidates can utilize the program without any geographical restrictions.

Keywords: Resumes, Recruiters, Job Opportunities, Resume Screening, Online job site, Skillset, Employers.

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1 Introduction

In the dynamic landscape of job markets, the tasks of resume screening and career recommendation stand as crucial elements for both job seekers and recruiters. As technology advances and new job trends emerge, candidates face increasing difficulty in identifying suitable job roles, while recruiters struggle to manually evaluate resumes to match them with appropriate job descriptions. To tackle these challenges and streamline the recruitment process, there has been a notable rise in the development of AI-driven resume analysers and job recommendation systems.

Traditional algorithms used for resume classification often rely on labelled data, which can be scarce and challenging to acquire. Additionally, existing methods for contextual embedding struggle to effectively handle large sets of resumes. To overcome these limitations, recent research proposes innovative approaches that utilize domain adaptation techniques based on graph neural networks. These techniques enable the classification of resumes without the need for labelled data and provide efficient handling of large resume datasets.

With the rise of online job listings, the registration process for organizations has changed significantly, attracting more candidates. However, this change also brings with it problems such as outdated information and diversity. To solve these problems, machine learning algorithms and web scraping technologies are used to perform a variety of tasks such as skills assessment, resume screening, job alerts, and appointment scheduling. These systems have features like virtual interviews, scheduled appointments, and advanced questions to make the hiring process more efficient.

Graph neural networks have emerged as an effective method for classifying texts, allowing global information to be captured by sending messages over images. Recent advances in functional recognition techniques have taken advantage of extensive information about concepts and language representations from large language models (LLMs). These systems bridge the gap between job requirements and job descriptions by using LL.M. s to analyze behavioral patterns related to working as a job candidate, find patterns, and create job descriptions.

In this research paper, we would like to find a good way to continue education during the transition period. This framework aims to address the challenges posed by economic shifts, globalization, and technological advancements in human resource management. By harnessing AI and deep learning techniques, the proposed framework offers personalized career guidance by estimating salaries based on resumes, identifying skill gaps, and suggesting learning paths for skill development. Furthermore, it assists recruiters in optimizing recruitment processes and enhancing employee retention strategies.

2 Literature Review

B. L. Prasad, et al. [1] The strategy employs advanced neural network frameworks for resume categorization, eliminating the need for tagged data. It achieved an 81% accuracy rate but struggles with refining performance, especially in categorizing resumes

by occupational groupings. To overcome this, Graph Neural Networks and NLP techniques are utilized to extract vital information from resumes and job postings. GloVe embeddings enhance semantic comprehension, while cosine similarity and TF-IDF ensure accurate job matching. Web scraping recommends the latest job opportunities. Integration of GNN-based domain adaptation methods aims to significantly improve accuracy and efficiency in resume screening and job recommendations, benefiting both candidates and recruiters.

Spoorthi, M. et al. [2]. Introduced an automated approach for classifying resumes using deep learning models. The system focuses on the skills specified in every resume. The system uses integrated learning tools, in which the calibre of the training data affects the system's accuracy. It's important to remember that biased or inaccurate training data may jeopardize the system's efficacy.

Gu, Y., et al. [3]. Text-MGNN, a novel technique for text classification, is proposed. It uses Graph Neural Networks to classify text by considering several levels of granularity and including a topic-aware perspective. When tested on three real-world datasets, it performs better than eleven baseline techniques. With the R8 dataset, the suggested technique achieves 97% accuracy.

Tripathi, R. C. et al. [4]. Intelligent automatic resume analysis and recommendation process. Proposed an approach with 87% accuracy that uses Intelligent automatic resume analysis and recommendations to simplify hard work and honest reviews.It presents an innovative approach to streamlining the recruitment process using automated technology. This system likely incorporates advanced algorithms and machine learning techniques to efficiently manage job postings, candidate applications, resume analysis, and applicant tracking.

T. M. Harsha et al. [5] Previous studies have explored automated methods to improve resume screening, addressing challenges posed by the high volume of resumes. Techniques such as Natural Language Processing (NLP) and machine learning algorithms have been utilized to extract and match candidate qualifications with job requirements. These approaches aim to streamline the screening process, reduce human involvement, and enhance recruitment efficiency. The present paper contributes by presenting a Python application that effectively automates resume screening based on organizational needs.

Wu, L. et al. [6] Defined big language patterns as a behavioral understanding and used that understanding to develop recommendations in the online recruiting context. They also introduced a new framework called GLRec, which combines behavioral information with LLMS to improve performance recommendations. They use AUC statistics to evaluate the performance of the framework.

Zhu, Y.et al.[7] Hybrid task recommendation algorithm for intelligent operation using user filtering. Proposed an inventive approach, a hybrid task proposal calculation coordinating client sifting strategies. By combining collaborative and content-based sifting, the calculation tailors personalized errand proposals in clever operation frameworks, pointing to improved effectiveness and client fulfilment through focusing on proposals.

Shaikym, A.et al. [8] Developed a study proposal and evaluated it using mixed methods. The system uses complex processes and algorithms. It shows the importance of students learning computer science with the help of their teachers for overall learning. These measures enhance intelligence and creativity and create a sense of collaboration and personal learning.

Petersheim, C.et al. [9] Presented a comparison analysis of resumes from different fields. According to their results, students are 7.4% more likely than recruiters to transfer their resume elsewhere. Students also spent an average of 7.2 seconds less time reviewing each requirement. Moreover, they found that the probability of a resume being advanced increased by 26.6-28.5% for every incremental point rise in GPA.

Pant, D., et al. [10] Created a technique for automated resume screening specifically for positions in software engineering. This system makes use of regular expression, word matching, character placement, and natural language processing. In an experiment conducted at random with 10 different resumes, the system was able to extract and summarise 70.59% of the talents listed in those resumes.

3 Proposed Methodology

3.1 Dataset Description

The system uses 2 different datasets collected by Kaggle. The first file, called the employer file, contains all the information regarding the job posting. The database includes company, education, skills, experience and job, category, field, industry, job title, etc. It contains more than 24,000 records, including 14 identifiers such as. Just persist the data. These articles are used to provide job recommendations and skills that match job listings and are useful in improving recruitment and job search. The second file, called the candidate record, contains all the information regarding the candidate's experience and skills. This database contains more than 17,000 documents. This information includes education, experience, employment, skills, and other activities. This information is used to provide job and skills recommendations based on job title and to help improve recruitment and job search.

3.2 Data Pre-processing

Preliminary data is key for gathering raw data for analysis. This process includes various techniques to prepare data for analysis, model training, and extraction. It begins by cleaning text, removing special characters to avoid issues with tokenization. Changing

over categorical values to numbers is significant for preparing information models. Content encoders help with this change, using name encoding to assign one-of-a-kind numbers to each category. This strategy is valuable for related categorical factors and when calculations handle encodings well. Another, we recognize inconsistencies, like exceptions, within the information. Dealing with exceptions ensures precise examination by removing or altering them to fit way better with the rest of the information, improving by and large accuracy. Taking care of exceptions guarantees exact information analysis and informed choices. Removing copy values during preprocessing and eliminating repeated data from the paper is crucial. Experiencing the same information different times can skew analysis, leading to inaccurate conclusions. We check the profile for repeated data, delete duplicates, and ensure data uniqueness for organized and accurate analysis.

Data Normalization. Finally, it is also important to develop tools that will improve the power, stability, and interpretation of machine learning models. Modeling helps solve performance evaluation issues, improves algorithm performance, and supports data comparison and interpretation by ensuring data is evaluated appropriately and efficiently. The normalization technique used is **"minimum-maximum normalization."**

$$z_{norm} = \frac{z - z_{min}}{z_{max - z_{min}}}$$

3.3 Modelling for Job Title Prediction

After the data is first processed, the data is divided into training, testing and optimization to facilitate the recovery process. Both K-nearest neighbor (KNN) and "Adaboost" models are carefully trained on the prepared data. We have successfully improved hyper parameters to improve their performance. However, the results obtained with this model do not make much sense in terms of the context of restarting the distributed operation. While these models are capable of processing existing data, they perform poorly when applied to unbranded products and cannot capture the subtleties inherent in text. This underlines the urgent need for a new recovery system that can decode recovery data and categorize them based on their context. Various methods such as pattern recognition, machine learning algorithms and natural language processing (NLP) are used. During the hiring process, Applicant Tracking Systems (ATS) are frequently used by hiring managers, recruiting agencies, and HR departments to optimize and filter resume data.

Algorithm. Adaboost

For I from 1 to N, $w_i^{(1)} = 1$

For $m = 1\ to\ M\ do$

Fit weak classifier m to minimize the objective function:

$$\in_m = \frac{\sum_{i=1}^{N} w_i^{(m)} I(f_m(a_i) \neq y_i)}{\sum_i w_i^{(m)}}$$

where

$$I(f_m(a_i) \neq b_i) = 1 \; if \; f_m(a_i) \neq b_i \; and \; 0$$

Otherwise $\alpha_m = \ln \frac{1-\epsilon_m}{\epsilon_m}$

For all I do

$w_i^{(m+1)} = w_i^{(m)} e^{\alpha_m I(f_m(x_i) \neq y_i)}$

End for

3.4 Estimating Score Between Job Description and Resume

For estimating the match percentage between an uploaded resume and the Job Description of a suitable job role the process will be as follows

Resume Screening. A resume parser was implemented to facilitate the hiring process. The objective was to create a tool capable of autonomously extracting pertinent details from resumes, thereby simplifying the task for recruiters and enabling efficient candidate evaluation.

The resume parser operates by dissecting each resume into distinct sections, including contact details, educational background, professional experience, skills, and accomplishments. Utilizing natural language processing methods, it analyzes the content within each section to extract essential information. This extracted data is then organized into a standardized format, facilitating easy access and review by recruiters.

Algorithm. Resume Screening

```
Input: resume_doc(text document of the resume)
Function{}
ResumeParser(resume_doc):
    cleaned_text = CleanText(resume_doc)
    sections = IdentifySections(cleaned_text)
    structured_data = {}
    for section_name, section_text in sections:
        data=ExtractInfo(section_name,section_text)
        MergeData(structured_data, data)
    ValidateData(structured_data)
return structured_data
```

Calculating Match Percentage. A method was devised to calculate the percentage match between job descriptions and the skills listed in resumes.

The cosine similarity algorithm calculates the cosine of the angle between two vectors, representing their similarity in a multidimensional space. Specifically, it compares the vectors representing the job description and the skills in a resume. By considering the orientation of these vectors, regardless of their magnitude, cosine similarity provides a reliable measure of how closely related the skills listed in a resume are to the requirements outlined in the job description. This calculation aids in quantifying the degree of match between the skills sought for a particular job and those possessed by a candidate, facilitating more efficient and informed hiring decisions.

Algorithm. Cosine Rule
Inputs:
- Vector A (represented as a list or array)
- Vector B (represented as a list or array)
  Function (CosineSimilarity(A,B)):
  dot_prod = sum(A[i] * B[i] for i in range(len(A)))
  mag_A = sqrt(sum(a ** 2 for a in A))
  mag_B = sqrt(sum(b ** 2 for b in B))
  similarity = dot_prod/ (mag_A * mag_B)
  return similarity

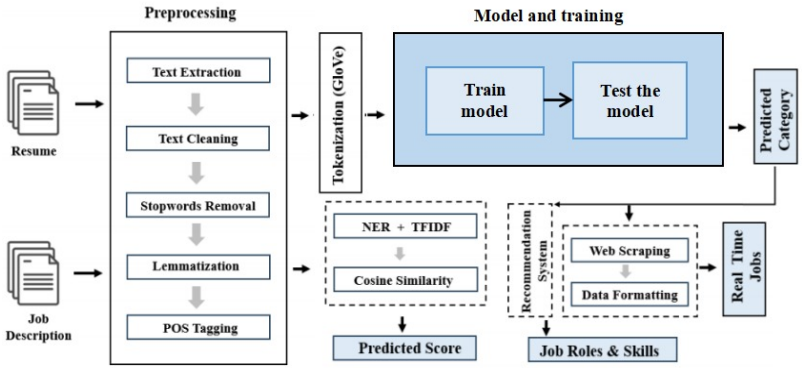

Fig. 1. Architecture for Resume Classification and Job Recommendation System

4 Experiments and Results

4.1 Matching Percentage

The portal calculates a similarity score between resumes that are uploaded and jobs that are applied for. With the aid of this tool, candidates may decide how well their experiences and skills match the job requirements and submit more thoughtful applications. The process starts by calculating the match percentage using "**cosine similarity**".

If the match percentage is greater than or equal to 70%, it will display: "Your resume matches approximately (Match Percentage) % of the job description. "Otherwise, it suggests that the user should work on their resume.

4.2 Job Title Prediction

The portal harnesses machine learning algorithms to anticipate job titles based on candidates' skills and experiences, offering a proactive approach to job searching. Even

without a predefined job title, individuals can leverage the platform's predictive capability to explore career opportunities tailored to their qualifications. Table 1 provides insights into the accuracy metrics of different machine learning models utilized in this process. The selection of the optimal model hinges on its accuracy in predicting suitable job titles, ensuring precision in the recommendations provided to candidates. Notably, the system autonomously identifies and employs the most effective machine learning algorithm for job title prediction, streamlining the process for users. AdaBoost stands out as the preferred algorithm for this task, distinguished by its superior accuracy in forecasting job titles. This strategic selection underscores the platform's commitment to delivering precise and relevant job recommendations, enhancing the overall user experience and facilitating informed career decisions.

Models	**Performance Metrics**			
	Accuracy	**Precision**	**Recall**	**F1-Score**
Decision Tree	0.855	0.897	0.82	0.878
Logistic Regression	0.855	0.914	0.803	0.855
KNN	0.81	0.879	0.747	0.808
Adaboost	**0.87**	**0.909**	**0.841**	**0.873**

Table 1. Performance Metrics of different algorithms

4.3 Recommends Sample Resumes

Implemented is a feature that recommends additional resumes when there's a significant mis-match, exceeding 70%, between the user's skills and the job description. This enhancement ensures that candidates closely aligned with the job requirements are prioritized for consideration. By setting a threshold of 70%, the system effectively identifies candidates whose profiles better match the job, simplifying the hiring process for recruiters. Additionally, resumes that are editable based on the calculated match percentage are recommended. The system also displays matched and unmatched skills by comparing the uploaded resume and job description, providing recruiters with valuable insights into candidate suitability, thereby optimizing the recruitment process. Furthermore, this feature aids recruiters in swiftly identifying the most suitable candidates by offering actionable insights into skills alignment, thereby optimizing the hiring process.

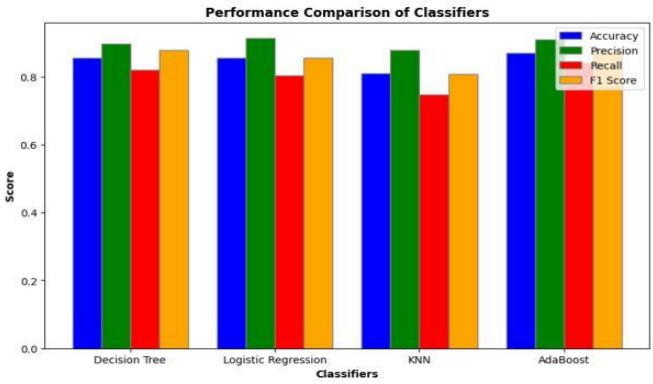

Fig. 2. Performance Comparison of different models

5 Conclusion

In the dynamic landscape of job markets, the tasks of resume screening and career recommendation stand the overall job search makes it easy and convenient to enter in many ways. Today's ever-changing business environment, coupled with an explosion of job opportunities, has individuals seeking better jobs and employers seeking top talent. As a result, many people have adopted job portals as the preferred way to access this lucrative job market and recognize the widespread use of these portals and their effectiveness in job search. But the potential to develop and support this application is huge.

Consider expanding the app's functionality to include feedback or reviews and search capabilities to include customer-appropriate, diverse, and geographically relevant parameters such as country, city, or region and the possibility of automating interview time by accepting or rejecting the job report or using a process for the company to delete job postings when they expire. Additionally, using email alerts to alert candidates to important job opportunities can streamline the job search process. Although the current rework of the application has successfully completed the main functions of the portal, there is still great potential to provide more power and energy to the platform. We've made significant improvements to the user interface to enhance its visual appeal and provide more useful information. We're also exploring additional features that can enhance user experience and better support the platform's functionalities. Through continuous improvement and innovation, our aim is to develop a functional website that exceeds the changing needs and expectations of job seekers and employers.

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