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A FULL-STACK JOB PORTAL THAT MATCHES RESUMES WITH JOB DESCRIPTIONS TO PROVIDE PRECISE RECOMMENDATIONS.

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Abstract: Job recommender systems (JRS) are specialized information filtering tools designed to assist job seekers in identifying job opportunities that align with their skills and experiences. These systems help users navigate the overwhelming volume of job postings on platforms such as LinkedIn and Indeed. Despite various strategies implemented in JRS, many fail to recommend suitable positions when evaluating multiple job offers. A common limitation is treating skills as static entities tied to job descriptions, without dynamically aligning them with job seekers' profiles. This paper presents a content-based job recommender system aimed at addressing these challenges by analyzing resumes and job descriptions to suggest the top-n relevant jobs for candidates. The proposed system leverages content-based filtering to measure the similarity between the skills extracted from resumes and the explicit features in job listings. Data was collected through web scraping of job descriptions from Indeed, focusing on major Saudi Arabian cities (Dammam, Jeddah, and Riyadh). Key skills in demand were analyzed, and recommendations were generated by matching these skills with those in candidate profiles. The effectiveness of the system was evaluated using decision support measures to quantify recommendation accuracy and error rates.

Keywords: Job recommendation, skill matching, content-based filtering, resume analysis, web scraping, decision support systems, natural language processing.

1.Introduction

In the fast-paced world of recruitment, where companies refine numerous resumes to identify the ideal candidate, the demand for automated solutions has never been more pressing. Recent advancements in machine learning algorithms now allow for the extraction of information from resumes with increased accuracy and speed. This extraction process involves parsing the resume to identify specific sections, such as the candidate's work experience, education, skills and other relevant details. Once extracted, this information can be employed to classify resumes based on set criteria, streamlining the selection process. With the surge of online resume platforms and the increasing dominance of digital recruitment (e-recruitment), there has been an overwhelming flood of data, intensifying the challenge of extracting valuable insights and metadata from resumes. This article delves into the extraction of metadata from digital resumes characterized by big data attributes, necessitating regular updates and ongoing monitoring. The efficacy of machine learning algorithms in resume classification is deeply rooted in the quality

and size of the training data. Moreover, the selection of the appropriate model architecture is crucial for optimal performance. While large language models (LLMs) like GPT-4 [1] have demonstrated remarkable results in various natural language processing tasks, they might not be the best fit for tasks demanding a deep understanding of specific language structures, such as resume classification. This is attributed to LLMs' [2] constrained capacity to encode and comprehend syntax, semantics and other linguistic nuances vital for resume classification. In machine learning, possessing a curated dataset is essential for training powerful models. This holds particularly true for classification tasks where precise tags or labels are important for achieving a noteworthy performance. The choice of datasets for training and evaluation is crucial. Our approach is multifaceted: we initially deployed web crawler's adept at aggregating resumes from online sources like Indeed.com. Following this, we employed natural language processing (NLP) techniques for data sanitization and preprocessing, ensuring the uniformity and quality of the collected resumes. A significant difficulty is the lack of labeled data, which is vital for machine learning algorithms' efficiency.

SCOPE AND OBJECTIVES

The scope of the Resume Builder Application encompasses a multifaceted platform catering to both candidates and organizations in their pursuit of effective job vacancy posting and hiring. For candidates, the application facilitates seamless resume creation and editing, enabling them to craft compelling profiles showcasing their skills, experiences, and achievements. With personalized templates and formatting options, candidates can tailor their resumes to specific job opportunities, while also gaining access to job search functionalities that match their profiles with relevant vacancies. On the organizational front, the application provides robust tools for posting job vacancies with detailed descriptions and requirements, streamlining the recruitment process. Organizations can efficiently screen, shortlist, and manage Candidates, leveraging features for communication, interview scheduling, and feedback sharing. Additionally, the application offers data analytics and insights to aid organizations in assessing job posting performance, candidate demographics, and diversity metrics. With a focus on privacy, security, and user support, this comprehensive platform serves as a valuable resource for both candidates and organizations, facilitating a seamless and efficient hiring process.

2.Literature review

The literature surrounding resume builder applications highlights their pivotal role in simplifying the complex process of resume creation. As outlined in the study presented in "Resume Builder Application Study Volume 8, Issue V (2021)," these applications offer users a range of features designed to streamline the generation of resumes. Customizable templates, efficient data processing capabilities, and error reduction mechanisms are among the key functionalities provided by these platforms. By focusing on enhancing user experience and elevating the overall quality of resumes, these applications alleviate the challenges individuals face when crafting their professional profiles. The findings suggest that resume builder applications offer a user-friendly and efficient alternative to traditional methods, contributing significantly to the creation of polished and impactful resumes. In contrast, the shortcomings of current job search websites and resume processing systems are critiqued in "The Resume Research Literature" by Prof. Hirendra Hajarev (2022). The literature highlights a noticeable lag in adaptation to advancements in computing and artificial intelligence within these systems. Existing systems are reported to rely heavily on manual search queries and basic similarity

metrics, which may lead to suboptimal matches and fail to harness the full potential of modern technology. The study underscores the urgency for a paradigm shift towards more sophisticated and user-friendly resume builder applications. Such a shift is deemed crucial for optimizing the job-seeking process, particularly in light of the evolving landscape of technology. By embracing advanced functionalities and leveraging AI-driven algorithms, resume builder applications can enable individuals to effectively present their qualifications and experiences in a competitive job market. Further analysis reveals that the advantages of resume builder applications extend beyond mere simplification of the resume creation process. These platforms offer users access to a wealth of resources, including industry-specific tips, sample resumes, and expert advice, which can help them craft resumes that stand out to potential employers. Additionally, resume builder applications often incorporate features such as resume tracking and analytics, allowing users to monitor the performance of their resumes and make informed adjustments as needed. This level of insight and control empowers job seekers to adapt their strategies in real-time, maximizing their chances of success in the job market. Marapaka et al. (2022) present a comprehensive study on resume builder applications in their work titled "Resume Builder Application Vol 8 Issue 3". The study emphasizes the role of these applications in simplifying the resume creation process through customizable templates and efficient data processing capabilities. The findings highlight the significance of resume builder applications in enhancing user experience and improving the overall quality of resumes produced. Risavy (2020) provides insights into the existing literature on resume research in "The Resume Research Literature: Where Have We Been and Where Should We Go Next?". The study critiques current job search websites and resume processing systems for their limited adaptability to advancements in computing and artificial intelligence. It advocates for a paradigm shift towards more sophisticated and user-friendly resume builder applications to optimize the job-seeking process. Kungwani et al. (2021) contribute to the literature with their work on "Analytical Resume Builder Vol. 24, Issue 2". This study explores the analytical aspects of resume building applications, focusing on the integration of advanced algorithms for personalized resume generation. The research underscores the importance of data-driven decision-making and optimization in enhancing the effectiveness of resume builder applications.

3.Methodology

The objective of our study was to explore the feasibility and benefits of augmenting real-world job resume data crawled from Indeed.com with synthetic resumes generated using ChatGPT and to perform the multiclass classification task. Our investigation spanned across 15 distinct job categories, ranging from technical roles like software developers to professional roles such as lawyers and various others in between. This section provides a detailed methodology encompassing data collection, data synthesis, machine learning methods and the experimental setup.

Data Collection from Online Sources and Processing

Resumes typically fall into two categories: structured and unstructured (free style). Structured resumes present a candidate’s details in distinct sections, such as education and work experience, usually in reverse chronological order. Unstructured resumes, however, follow a narrative approach without specific divisions. Indeed.com predominantly showcases structured resumes, but variations within this format can complicate metadata extraction. To enhance

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labor market insights, it is crucial to utilize data from platforms like Indeed.com that mirror industry needs and offer insights into a diverse range of job categories, enabling a thorough analysis of labor market trends, skill prerequisites and other employment-influencing factors.

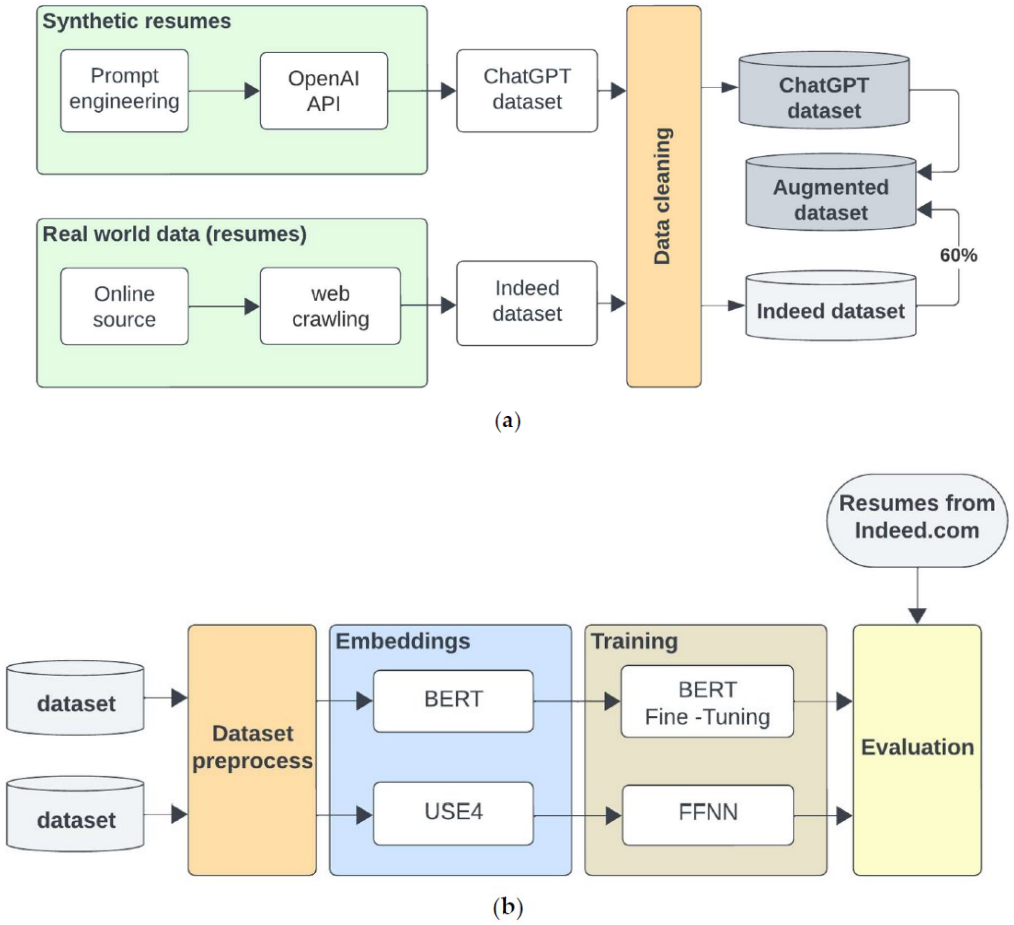

Figure 1. (a) Data collection and preprocess pipeline; (b) training and evaluation pipeline.

Data Collection from Online Sources and Processing

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FFNN Model

The FFNN was designed specifically for multiclass classification. The selection of its architecture and other hyperparameters was determined based on literature insights and our trial-and-error experiments, particularly focusing on the model's architecture, optimizer choice, learning rate and rho values. Its architecture consists of an input layer with 512 units, aligned with the feature vectors generated by the USE4 model. USE4, a pretrained embedding model, converts textual data into fixed-size feature vectors, encapsulating semantic nuances, enabling the FFNN to discern data intricacies without directly interfacing with the raw text.

BERT Model

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Our BERT model, sourced from Hugging Face's library was tailored for text classification. BERT, a transformer-based model, generates embeddings that reflect contextual relationships within text, making it a powerful tool for capturing semantic nuances in large textual datasets. These embeddings are derived from multiple transformer layers, allowing the model to consider both the current word and its surrounding context in the text. For data preparation, we curated datasets for training and evaluation.

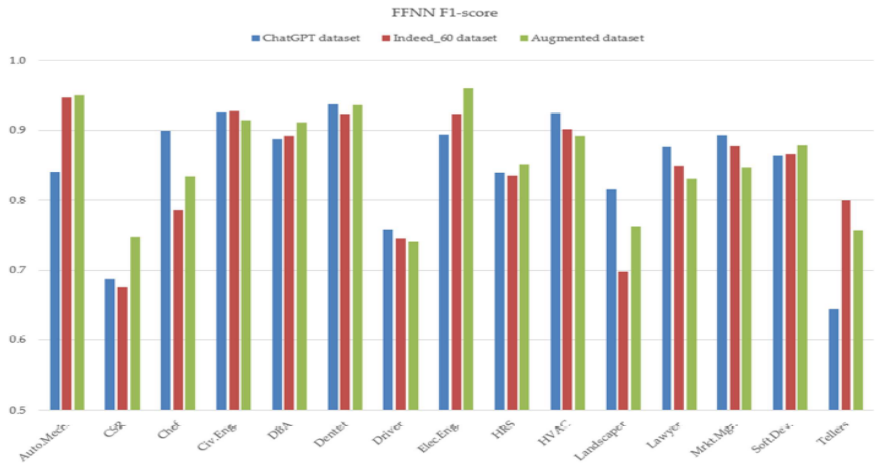
Results:

In our previous research we investigated the use of synthetic data generated using ChatGPT for training within the context of resume multiclass classification. Evaluating the model's performance using the Indeed dataset, we found that synthetic datasets, indeed, had potential value in the domain of e-recruitment. the results (experiments one and two) pertaining to the FFNN employing USE4 embeddings when tasked with resume classification according to job categories. To ensure a comprehensive examination of this task, we conducted an analogous experiment leveraging the BERT model.

The evaluation of Resume2Vec and the ATS was conducted using two ranking metrics, namely Normalized Discounted Cumulative Gain (nDCG) and Rank-Biased Overlap (RBO), across five distinct job categories: Data Science, Health and Fitness, Mechanical Engineering, Operations Management, and Software Testing. The results provide an insight into the comparative performance of the two approaches and highlight the strengths of Resume2Vec in most categories, as shown in Figure

Table: Prediction accuracy and model performance for all experiments per class.

Exp.	Model	Training Dataset	Evaluation Dataset	Accuracy	Precision	Recall	F1-Score
1	FFNN	ChatGPT	Indeed	0.85	0.85	0.85	0.85
2	BERT	ChatGPT	Indeed	0.85	0.85	0.85	0.85
3	FNN	Indeed_60	Indeed_40	0.84	0.86	0.84	0.84
4	BERT	Indeed_60	Indeed_40	0.85	0.88	0.86	0.86
5	FNN	Indeed augmented	Indeed_40	0.85	0.86	0.85	0.85
6	BERT	Indeed augmented	Indeed_40	0.92	0.92	0.92	0.92



The experimental results showcased in Table 1 demonstrated the impact of the different models and training datasets on the accuracy of resume multiclass classification and presented the

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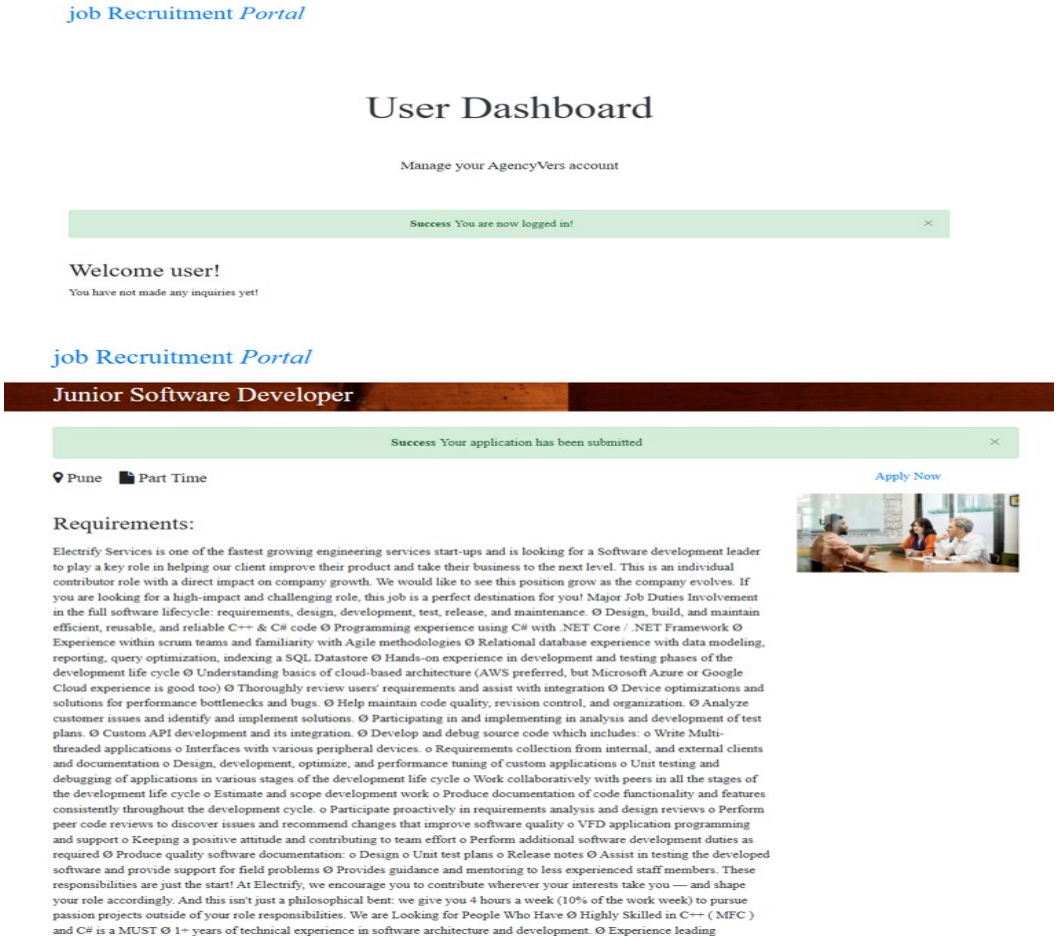
average performance metrics, offering a comparison between these methods in a per-class manner. In the third experiment, utilizing the FFNN model with the Indeed_60 training dataset, we achieved an accuracy of 84%. The fourth experiment introduced the BERT model to the same training dataset, resulting in an improvement of 85% accuracy. Experiment five maintained the FNN model but employed an augmented version of the training data. Indeed, the augmented dataset improved the accuracy to 85%. The most improved accuracy was observed in the sixth experiment, where the BERT model was combined with the Indeed augmented dataset, resulting in a 92% accuracy. These results underscored the significance of both model selection and the quality of the training data, highlighting the potential of advanced models like BERT when coupled with augmented datasets for enhancing the accuracy of resume classification tasks.



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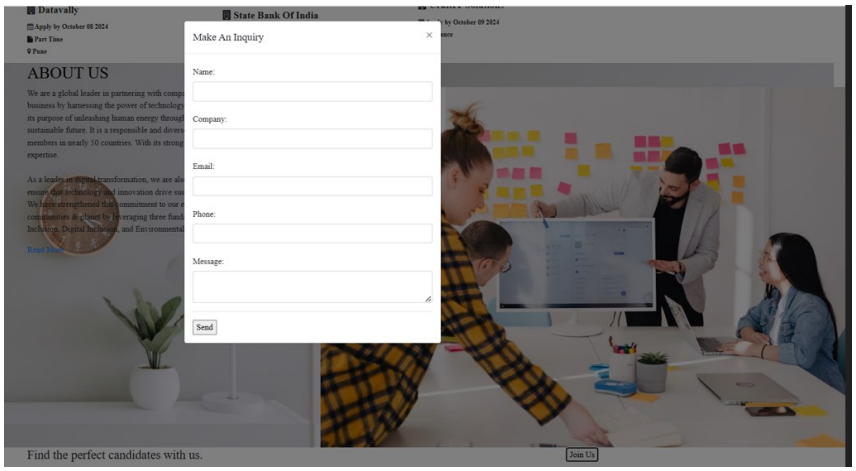

Conclusion:

In conclusion, the Resume Builder Application stands as a pivotal solution in the realm of job vacancy posting and hiring, catering to the needs of both candidates and organizations alike. By providing intuitive resume creation tools, personalized job matching capabilities, and streamlined recruitment processes, the application empowers candidates to present their qualifications effectively while assisting organizations in identifying and selecting top talent. With a focus on user experience, data privacy, and comprehensive support, the platform fosters a symbiotic relationship between candidates and organizations, facilitating efficient communication and collaboration throughout the hiring journey. As a result, the Resume Builder Application emerges as a transformative tool in the modern job market, bridging the gap between talent and opportunity with unparalleled efficiency and effectiveness.

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