iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** III **Month of publication:** March 2024

DOI: https://doi.org/10.22214/ijraset.2024.59069

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue III Mar 2024- Available at www.ijraset.com

Resume Optimisation and Suggestions using Large Language Models: A Review

Sai Ganesh Mandala[1], Ruthvik Reddy Korem[2], Karthik Karmakonda[3]
[1, 2]*Student, Dept. of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Telangana, India*
[3]*Assistant Professor, Dept. of Computer Science and Engineering, Chaitanya Bharathi Institute of Technology, Telangana, India*

Abstract: ***In the rapidly evolving job market, the compatibility of a candidate's resume with the job description is critical to the application process. Conventional resume optimization techniques frequently depend on keyword matching, which is shallow and cannot comprehend linguistic nuances or context, resulting in an inadequate match between applicant's profiles and job criteria. This study presents a novel application that uses Bidirectional Encoder Representations from Transformers (BERT) to generate language embeddings from job descriptions and resumes, therefore bridging this gap. Our program offers a context-aware and nuanced evaluation of how well a candidate's qualifications match the requirements of the position by calculating the similarity scores between these embeddings. Furthermore, the incorporation of Generative Pre-trained Transformer (GPT) models provides customized suggestions for resume optimization, emphasizing areas of improvement indicated by the BERT study. Additionally, the application also has a job search tool that lets the users browse LinkedIn for suitable job posts and apply straight to them. The advantages of BERT over traditional keyword-based matching techniques are covered in this paper, including its ability to recognize the contextual relationships between words and phrases, providing matches that are more relevant and accurate. The proposed approach greatly improves candidate's chances of landing desired positions by enabling them to modify their resumes and facilitating a more efficient job application process. The incorporation of BERT's deep learning capabilities with GPT's generative recommendations signifies a significant progression in the career development technologies domain, offering theoretical and practical insights.***

Keywords: Bidirectional Encoder Representations from Transformers (BERT), Sentence Embeddings, Generative Pre-trained Transformer (GPT).

I. INTRODUCTION

The relationship between developments in artificial intelligence and the hiring process offers a rich environment for innovation in the constantly changing realm of employment and technology. This project is the foundation for an extensive review paper that explores a wide range of research studies and looks at the integration of state-of-the-art artificial intelligence technologies, namely Generative Pre-trained Transformer (GPT) models for content creation and suggestions for improvement and BERT (Bidirectional Encoder Representations from Transformers) for generating sentence embeddings. At the center of this project is a new application that combines these technologies in a way that redefines the job search process. The application determines a compatibility score by using BERT's powerful sentence embeddings to analyze the alignment between a user's resume and the job description of their desired employment. This score provides a quick assessment of how well an applicant's qualifications meet the job requirements and also acts as a basis for customized enhancements. By making use of GPT's generative powers, the application suggests precise resume improvements that will make it more tailored to the position in consideration and increase the applicant's chances of getting shortlisted. Additionally, an exploratory element of the project gives users the ability to look for other career options by opening a portal to LinkedIn's vast job listings.

This integrated strategy opens up more options for job seekers to consider a greater range of possible employment opportunities in addition to optimizing individual resumes for particular applications. The review paper highlights the application's creative use of AI to expedite the job application process and attempts to capture the scope of research and development in this field. The paper will highlight the importance of this initiative in the context of modern job-seeking tactics by a thorough study and synthesis of the body of existing literature, highlighting its potential to greatly improve the effectiveness and results of job applications. This project represents a turning point in the technological advancement of job market navigation, combining AI's analytical capabilities with user-friendly interface design to enable job seekers to navigate the complexities of the process with increased success, efficiency, and ease in the future.

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II. RELATED WORK

More complex candidate selection processes are becoming the norm as a result of the recruitment industry's incorporation of machine learning (ML) and natural language processing (NLP). These cutting-edge tactics not only expedite the hiring process but also add a degree of accuracy that was not possible with conventional approaches. A fundamental study in this field demonstrated an innovative approach by utilising semantic features in resumes, obtaining a remarkable 92% accuracy rate in differentiating applicants according to these features. By putting analytical depth and accuracy first, this method dramatically outperforms traditional keyword-based analyses, demonstrating the potential of sophisticated algorithms to transform candidate selection [1].

Another study investigated the automation of resume screening with text mining techniques in order to solve the particular issues within the software engineering recruitment landscape. This study used techniques including resume summarising, information extraction, and ontology mapping to address the biases and inefficiencies of manual screening. The conversion of resumes into text files that can be analysed made it easier to evaluate candidates' qualifications in terms of education, work history, and abilities. The fact that this study was able to increase recruiting efficiency shows how important text mining is to the modernization of applicant screening procedures, particularly in the technical sectors [2].

One major step towards automating the screening process is the creation of the "Resume Screener" tool. This Python-based programme evaluates resumes in many formats using NLP and ML to precisely match candidate abilities with job requirements. This solution highlights the scalability, time efficiency, and reduced bias potential in recruiting procedures, addressing the issues of time consumption and biases associated with human screening. The "Resume Screener" is a scalable and objective method for candidate evaluation that serves as an example of the revolutionary power of integrating sophisticated analytical tools in recruitment [3].

A study that uses the BERT algorithm, which offers a sophisticated substitute for traditional word-matching algorithms, makes a significant contribution to resume categorization. This approach improves resume content interpretation through semantic analysis by preparing resumes and producing BERT embeddings. This study's notable gain in classification accuracy highlights the benefits of context-aware algorithms in offering a more thorough and accurate assessment of prospects, signalling a major advancement in recruiting technology [4]. The significance of technologies like Optical Character Recognition (OCR) and Named Entity Recognition (NER) in automating the recruitment process cannot be highlighted. A thorough analysis of these technologies covered their shortcomings as well as their innovations, emphasising how they have helped to streamline data extraction and document processing. The aforementioned analysis highlights the significance of these fundamental technologies in augmenting the efficacy and precision of candidate screening, hence promoting a more seamless integration of automated systems in the recruiting process [5]. Another study suggested an automated resume screening system that uses natural language processing (NLP) techniques to avoid the time-consuming manual resume analysing process. Using a dataset of about 1000 resumes, a neural network model was trained, and the system showed impressive accuracy in assigning resumes to various job roles. This accomplishment confirms that ML and NLP combined are effective in improving the resume screening process, offering a more accurate and efficient substitute for conventional screening techniques [6].

One significant advancement in e-recruitment is the creation of a comprehensive structure for analysing resumes and extracting structured data. This framework attempts to automate critical operations such as skill matching and resume parsing by utilising text extraction, categorization, NER, and skill ontology. This project, which aims to enhance the information extraction process and the overall efficiency of the recruiting cycle, emphasises the continued need for innovation in recruitment technologies [7].

Another study achieved great accuracy in job classification and suggestion by using an NLP-based methodology for both resume screening and job recommendation. This method, which includes gathering datasets, preprocessing them, and training models, is a prime example of how NLP may revolutionise the hiring process. It offers a practical and efficient way to automate important hiring duties, expediting the process of finding qualified applicants for open positions [8]. In order to improve talent acquisition strategies for businesses and streamline the job search process for candidates, a thorough resume analysis and position recommendation system has been implemented. This system evaluates candidates based on their competitiveness and suggests appropriate job openings by using machine learning and text mining techniques to analyse resumes. The efficacy of the system, as confirmed by an online survey, suggests that it has the potential to dramatically enhance the recruitment environment by providing a more individualised and effective method of job matching [9].

Finally, the use of ML algorithms for resume classification has made it possible to conduct the hiring process in a more organised manner. In order to accurately sort resumes by profession or field, this study used a variety of machine learning classifiers to analyse a heterogeneous dataset of resumes. The high accuracy attained by all classifiers demonstrates the potential of machine learning to expedite the hiring process and help businesses find qualified applicants more quickly across various industries [10].

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To summarise, the inclusion of ML and NLP into the recruitment market represents a substantial advancement in candidate selection procedures. The highlighted studies and discoveries highlight the critical importance of these technologies in improving candidate selection, implying interesting future advances in the field. As technology advances, the potential for additional improvements in recruitment through ML and NLP remains enormous, ushering in a new era of efficiency and precision in the sector.

III.COMPARISON ANALYSIS

The collection of research under examination highlights various approaches and technological tools utilised to improve the screening of resumes and job matching procedures. It highlights the significance of machine learning (ML) and natural language processing (NLP) in optimising applicant selection.

In an attempt to increase the accuracy of candidate-career matching, the first series of experiments shows how sophisticated machine learning and natural language processing techniques may be applied to analyse semantic features from resumes. Experimental results verify this approach with high accuracy levels of up to 92% in semantic analysis-based candidate discrimination [1][2]. These results highlight the value of using context-aware algorithms for a more thorough assessment of resumes, which is a major change from the conventional keyword-based screening techniques.

The creation and application of specific tools and frameworks intended to improve and automate the resume screening process is a second theme that emerges from the review. This covers creative fixes like the "Resume Screener" and extensive parsing frameworks that make use of natural language processing (NLP) to effectively match candidate qualifications to job requirements. These contributions demonstrate the trend towards the creation of recruitment technologies that are impartial, flexible, and scalable, providing workable answers to the drawbacks of manual screening procedures [3][7].

Subsequent research presents state-of-the-art resume categorization algorithms that are context-sensitive, like BERT. Compared to traditional text-matching algorithms, the application of BERT and other cutting-edge models shows improved performance in recognising the semantic context of resume material. By adding contextual semantics to the analysis, this algorithmic sophisticated breakthrough dramatically improves classification accuracy [4].

Apart from algorithmic advancements, the study corpus comprises evaluations of crucial technologies like as OCR and NER, which are important for automating recruiting procedures. Future innovations in automated recruitment and candidate selection are facilitated by these reviews, which offer insights into the difficulties and achievements in document processing and data extraction [5]. Utilising neural network models to automate resume screening is another main focus of the research. These models demonstrate the ability to effectively classify resumes into job roles, demonstrating an efficient use of ML to handle real-world recruitment difficulties. The fact that these models are able to achieve high accuracy for automated classification shows how useful they are for improving efficiency and recruiting operations [6][8]. Finally, the combined knowledge gained from these research highlights the opportunities and difficulties associated with using ML and NLP in the recruitment space. Although the research shows notable technological and methodological advances, it also highlights the need for more research and innovation, especially to increase the efficacy and generalizability of automated systems in a variety of recruitment scenarios [9][10].

Overall, the comparative research shows that developments in ML and NLP are driving a progressive shift towards more advanced, effective, and impartial ways for matching resumes and finding jobs. The variety of methods and ongoing innovation in this industry highlight how these technologies have the potential to revolutionise conventional hiring procedures.

TABLE I
Literature Survey

SNo.	Paper Title & Year	Methodologies Used	Observations
1	Comparative Semantic Resume Analysis for Improving Candidate-Career Matching (2022)	Utilization of the ranking support vector machine (SVM) algorithm	Up to 92% accuracy in evaluating resumes based on qualities, exceeding traditional ranking techniques.
2	Automatic Software Engineering Position Resume Screening using Natural Language Processing, Word Matching, Character Positioning, and Regex (2022)	The approach uses natural language processing, character alignment, and keyword matching to automate the screening of software engineering resumes.	According to the study, label character position-based approaches perform well for structured resumes, whereas keyword and phrase matching extracts 33.59% of skills accurately from unstructured resumes.

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3	Automated Resume Screener using Natural Language Processing (NLP)(2021)	The" Resume Screener" uses Natural Language Processing (NLP) to transform Word and PDF resumes into PDFs by analysing the text within the resumes. It makes use of the Model View Controller (MVC) architectural paradigm for code organisation and a CSV dataset for skill comparison.	The application uses natural language processing (NLP) to analyse text content and efficiently screens resumes in a variety of formats. A graphical depiction of skill frequencies is included in the result, which increases resume screening process efficiency while saving time and resources.
4	Improved Resume Parsing based on Contextual Meaning Extraction using BERT (2023)	Contextualising documents using the BERT algorithm required pre-processing via tokenization, TF-IDF computation, and pre-training that made use of BERT's masked language modelling.	Using BERT, resume categorization was im- proved. Cosine similarity was used to quantify performance, indicating superior document similarity analysis.
5	Resume Matching Framework via Ranking and Sorting Using NLP and Deep Learning (2023)	Used a thorough framework for effective resume matching and sorting that made use of OCR, deep learning (BERT and YOLOV8), text categorization, and entity recognition.	High F1 scores for text categorization using BERT, effective integration of YOLOV8 for text section recognition, and encouraging outcomes in terms of automating and improving the effectiveness of the hiring and recruitment process were all displayed.
6	Resume Screening using NLP and LSTM (2022)	The project's technique consists of gathering input data, pre-processing the text input, tokenization, vectorization, training the model, and storing the model.	Among the observations are the creation of an application that divides resumes into several job categories according to skill sets, and the possibility of future updates that will pull applicant data from GitHub and LinkedIn pro- files.
7	Resume Parsing Framework for E- recruitment (2022)	Presented a system for parsing resumes that uses bespoke skill ontology for data enrichment, NER for facts detection, and Boolean Naive Bayes for text block classification.	The proprietary skill ontology enriches extracted skills, and the framework speeds information extraction from resumes, especially improving accuracy through Boolean Naive Bayes and NER. Future work will in- volve testing and assessment on real-world e-recruitment data.
8	Resume Analysis and Job Recommendation (2023)	Data preprocessing, testing, site scraping, model training with the multinomial NB algorithm, and determining the similarity index between talents were all part of the study's approach.	Future work will involve tests and evaluation on real-world e-recruitment data. The framework simplifies information extraction from resumes, especially improving accuracy with Boolean Naive Bayes and NER. Meanwhile, the proprietary skill ontology improves extracted skills.
9	Based on the application of AI technology in resume analysis and job recommendation (2020)	The study's methodology applies artificial intelligence based on text mining and machine learning, as well as the latest big data technologies. The study's main objectives are to evaluate how popular online conversations are and to create a method that may be used in sizable job fairs.	Competitiveness scores, DISC personality analyses, and resume-based job vacancy recommendations were all offered by the job recommendation system.

10	Resume Classification Using ML Techniques (2023)	The most accurate resume categorization algorithms were found to be Support Vector Machine, Random Forest, Decision Tree, and KNN.	This study proposes an ML-driven approach to expedite classification, saving money and effort. One notable option for improving hiring process accuracy and efficiency is the Support Vector Machine algorithm.

IV. CONCLUSION

To summarise, incorporating advanced machine learning (ML) and natural language processing (NLP) techniques into the recruitment process offers a huge step forward in career development and job matchmaking. When combined with the generative powers of Generative Pre-trained Transformer (GPT) models, the application of Bidirectional Encoder Representations from Transformers (BERT) for generating sentence embeddings provides a sophisticated, nuanced approach to resume optimisation and job matching that significantly outperforms conventional keyword matching methods. This collection of studies emphasises how ML and NLP technologies can improve candidate-job matching accuracy and efficiency, hence having a revolutionary effect. Through the utilisation of BERT's contextual analysis and GPT's generative ideas, candidates can enhance their resumes to an unparalleled degree of accuracy, hence considerably raising their chances of landing desired job jobs. Moreover, users may locate and apply to relevant positions more easily thanks to the integration of a job search feature that connects with LinkedIn and streamlines the application process. The comparative examination of research in this area demonstrates the wide range of approaches and tools used to overcome the drawbacks of conventional hiring procedures. These developments show a trend towards more effective, objective, and tech-driven hiring practices. Examples include the use of semantic analysis and the creation of extensive parsing frameworks. Furthermore, the necessity of document processing and data extraction in automating the recruitment workflow is emphasised in the examination of the function of foundational technologies like Named Entity Recognition (NER) and Optical Character Recognition (OCR). These technologies ensure a smooth integration of automated systems and are the foundation for the effective application of ML and NLP in recruitment. The investigation of automated resume screening and job suggestion systems, as well as the presentation of resume parsing frameworks, demonstrate how these technologies might be used to solve real-world recruitment problems. These tools give job seekers more ways to investigate possible employment prospects in addition to streamlining the application process. This review paper offers both theoretical and practical contributions to the topic, highlighting the crucial role that ML and NLP technologies play in reshaping the recruitment environment. Through contextual knowledge and personalised enhancement suggestions, the suggested approach closes the gap between resumes and job descriptions, signalling a major advancement in career development technologies. The use of such technology promises to transform the way employers and candidates interact, promoting a more effective, efficient, and fair hiring process as the labour market continues to change.

V. ACKNOWLEDGMENT

We would particularly like to thank the Chaitanya Bharathi Institute of Technology's Department of Computer Science and Engineering for their remarkable cooperation and valuable contributions. We would also want to use this chance to express our gratitude to everyone who has helped us in this endeavour. Without their enthusiastic support, motivation, and cooperation, the research paper could not have developed.

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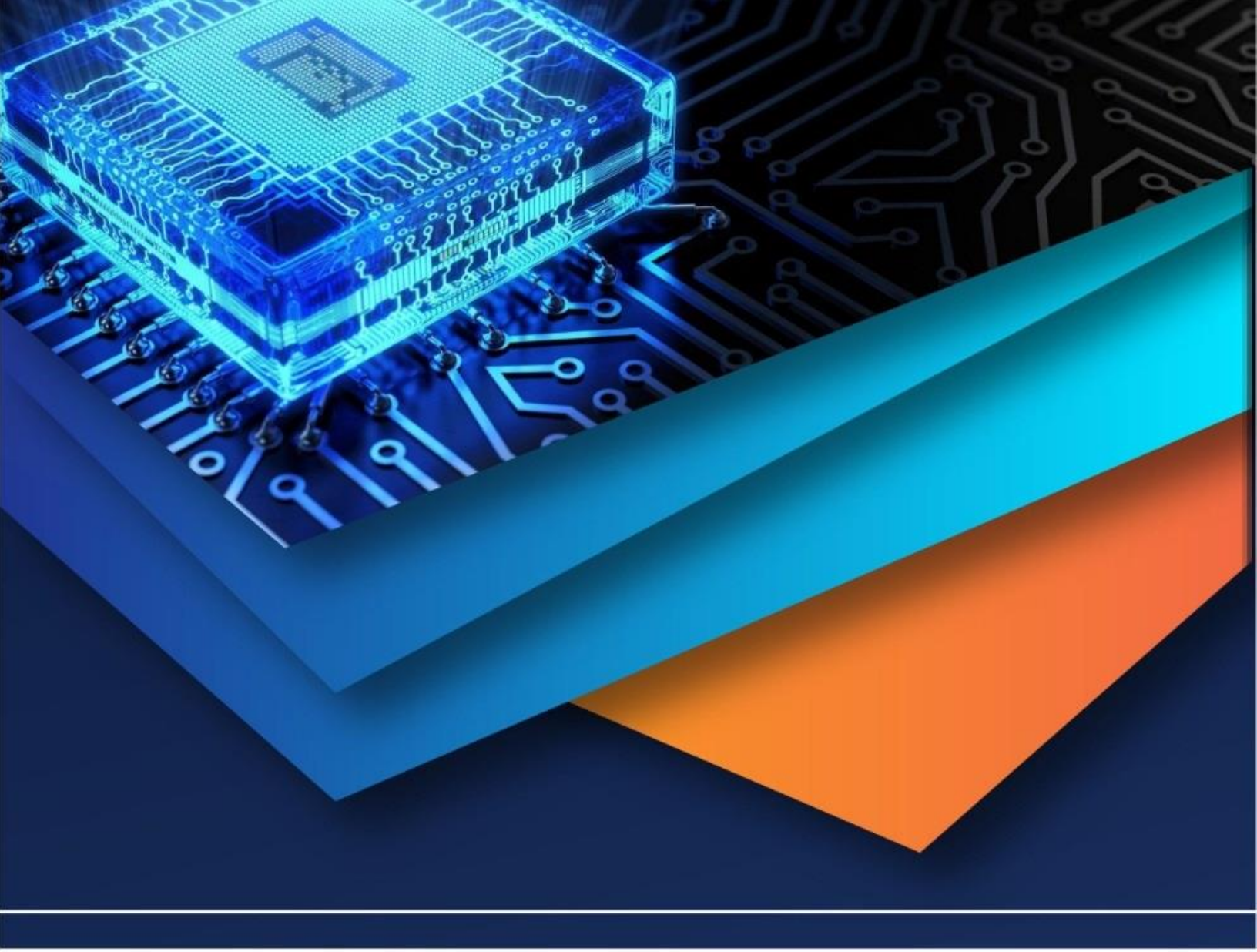
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