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Intelligent Resume Matching System

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Abstract: Optimally efficient and smart resume screening is a key factor towards optimizing the recruitment processes, particularly with the recent huge number of applicant resumes in modern day labor markets. The contribution put forward herein suggests an Intelligent Resume Matching System to efficiently automate shortlisting resumes against vacancy announcements based on powerful natural language processing (NLP) methodologies and machine learning approaches The system makes use of BERT-based sentence transformers to create high-dimensional contextual embeddings from job postings and resumes both, directly derived from PDF documents through pdfplumber.

To measure candidate-job fit numerically, the system calculates cosine similarity between embeddings and enables dynamic threshold-based filtering. Candidates whose resumes are at or above similarity threshold are shortlisted and informed through automated emails. Additionally, the system has a feedback mechanism powered by a large language model (LLM) to suggest personalized messages for unselected candidates, providing constructive feedback on possible skills or experience gaps.

The proposed system not only increases the accuracy of resume-job matching but also minimizes manual labor and guarantees customized candidate interaction. Through the integration of NLP-based embedding methods with automation and interpretable feedback, the system proves to have potential for large-scale deployment in contemporary hiring pipelines.

Keywords: Resume Matching, BERT Embeddings, Cosine Similarity, NLP, Job Fit Prediction, Automated Recruitment, PDF Extraction, Intelligent Screening, LLM Feedback, Recruitment Automation

I. INTRODUCTION

Hiring has witnessed a paradigm shift in the recent past, moving from manual to intelligent systems with promises of higher speed, accuracy, and equity. The greatest challenge of today is the effective screening of enormous amounts of unstructured resumes applied for every vacant job. Manual screening tends to be inefficient and human-error prone, resulting in slow hiring decisions and lost opportunities [6]. Conventional keyword-based filtering mechanisms, although automated, are constrained in their capacity to understand the context and semantics inherent in candidate profiles [1].

To overcome these limitations, the use of Natural Language Processing (NLP) and Machine Learning (ML) has picked up pace in the creation of smart resume matching systems. These methods enable semantic comprehension by transforming unstructured resume information into structured representations through the use of embedding techniques. For example, vector space models paired with cosine similarity have been found to greatly improve the matching of resumes to job descriptions based on contextual importance, as opposed to keyword frequency [2].

This project suggests an Intelligent Resume Matching System that will parse resumes automatically, perform semantic matching, ranking, and personalized communication with candidates. The system makes use of BERT-based sentence transformers to create context-aware embeddings for resumes (parsed using pdfplumber) and job descriptions. Cosine similarity is computed between the embeddings, and a threshold can be configured to filter and shortlist the best candidates.

What makes this system stand out is its candidate-focused communication process. Automatically shortlisted candidates are sent acceptance emails, with those who are not selected being given customized feedback, created through a Large Language Model (LLM), for providing an indication of areas of possible improvement [20]. This introduces transparency to the process and aids in long-term candidate development. Besides, the system combines AI-powered resume ranking and tracking functionalities with recent studies demonstrating the efficiency of intelligent tools like Google Gemini Pro in augmenting hiring pipelines [7]. Automating interaction as well as decision-making, the system enhances recruiter effectiveness as well as candidate experience.

In addition, other machine learning-based resume ranking models have proven the utility of content-based recommendation systems in precisely recommending appropriate candidates, even from big data [8]. Real-time feedback systems, as employed in contemporary resume improvement tools, also support the significance of directing job seekers according to dynamic market expectations [2].



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Overall, this study seeks to close the gap between candidate potential and job need via an intelligent, scalable, and transparent recruitment platform—opening up a more equal and efficient hiring process [4].

II. RELATED WORK

An Automated Resume Screening System Based on Natural Language Processing and Similarity, Engineering, Technology & Innovation Transactions [1].

The study proposes an NLP and cosine similarity-based automatic resume screening system to overcome the inefficiencies inherent in manual screening.

The technique increases the effectiveness of hiring by extracting pertinent details and matching resumes to job profiles, thereby providing recruiters with a relatively cost-effective, time-saving solution compared to keyword-based systems. Future studies could concentrate on improving extraction models and managing more challenging resumes.

Resume Parser applying ML and NLP, International Research Journal of Modernisation in Engineering, Technology, and Science [2]. This work presents a Resume Parser and Enhancement System (RPES) automating resume creation and improvement by means of NLP and machine learning Dealing with the lack of personalisation in conventional resume writing, it provides job seekers with automated recommendations to properly customise resumes for particular positions, so improving their chances in highly competitive markets. Adaptive feedback loops for dynamic personalising could be included into further developments.

Automated Resume Parsing and Job Domain Prediction using Machine Learning, Indian Journal of Science and Technology [3]. The authors talk about the use of an automatic approach based on BERT and TF-IDF models for resume parsing and job domain prediction. Aimed at optimizing recruitment processes, it reduces reliance on manual interventions and enhances the accuracy of matching job roles and applicants. More advanced domain-specific modeling can be used in future work to make even finer predictions.

Intelligent Resume Tracking System, Journal of Technology [4]. An intelligent resume tracking system using machine learning is proposed to overcome inefficiencies in manual recruitment processes. It utilizes NLP and advanced feature extraction to accurately match candidates to job descriptions, significantly enhancing recruitment timelines. Continued development could integrate real-time feedback systems and broader industry adaptation.

Resume Parser using TF-IDF, International Journal of Advanced Research in Computer and Communication Engineering [5]. The research offers a resume ranking solution leveraging TF-IDF, cosine similarity, and Mong string matching. Focused on improving the robustness of existing systems, it ensures higher accuracy in comparing resumes to job descriptions, especially for large-scale recruitment in MNCs and government organizations. Future studies could aim at multi-language resume parsing capabilities.

Resume Screening, IJRASET [6]. This work proposes an NLP-based computerized resume screening system to avoid the traditional demerits of manual screening like human error and time consumption. The machine learning algorithm and keyword extraction-based system enhances accuracy of candidate-job matching. Adaptive learning to manage dynamically changing job requirements can be explored in the future.

Resume Application Tracking System using Google Gemini Pro, International Journal for Research in Applied Science and Engineering Technology [7]. The research comes up with a resume tracking system coupled with Google Gemini Pro that uses AI algorithms to automate candidate screening and enhance recruitment efficiency. By maximizing the accuracy of resume parsing and job matching, the system is a major technological innovation in recruitment processes. Future research might investigate integrations into larger ATS systems.

Design and Development of a Machine Learning-Based Resume Ranking System, Global Transitions Proceedings [8]. Here, a machine learning-based resume ranking system is presented, which uses cosine similarity and K-Nearest Neighbors (KNN) algorithms. It is designed to optimize and automate the screening process with timely and precise matching of candidates to job vacancies. Real-time flexibility towards various industry sectors could be the area of expansion.

Resume Parser Using NLP, International Journal of Advanced Research in Computer and Communication Engineering [9]. Through the application of NLP and machine learning, the paper proposes an intelligent automatic parsing of resumes and suggesting improvement to the profiles. User interaction and data management are handled using Streamlit and MySQL. Recruitment is made better through the process in information extraction on top prospects and offering actionable recommendations. Future development can include multilingual resume processing.

A CV Parser Model based on Entity Extraction Process and Big Data Tools, International Journal of Information Technology and Computer Science [10]. The article proposes a CV parser model based on entity extraction processes and big data tools to enhance efficiency in parsing various resume formats.



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The process automates extraction of primary information, lessening manual labor immensely. Handling multimedia CV components and increasing cross-format flexibility can be areas for future research.

gurukul international multidisciplinary research journal [11], application tracking system This paper proposes an application tracking system meant to automate handling of job applications. By means of modern technologies, it improves accuracy and efficiency in the hiring process and streamlines procedures. Future improvements could involve predictive analytics for candidate probability of success.

A Machine Learning Methodology for Resume Recommendation System Automation, Procedia Computer Science [12]. The system proposes a machine learning-based approach for resume recommendation and classification automation. With the use of content-based recommendation techniques and k-NN classifiers, candidate-job matching is optimized with reduced hiring time. Incorporating behavioral analytics to further enhance candidate recommendations can be included in the future.

Learning-Based Matched Representation System for Job Recommendation, Computers [13]. This study proposes a learning-based matched representation system to address challenges of providing meaningful job matches. Techniques in machine learning allow customization of matching through features and preferences of candidates.Reinforcement learning can help to attain ever-growing matching accuracy going forward.

Tracker of JSRASET Placement [14]. A Placement Tracker app seeks to compile job openings from several sources into a logical, intuitive platform. By means of real-time updates, filtering, and application tracking, it aids job seekers. Employment recommendations driven by artificial intelligence could be included going forward.Resume searching to determine best candidate based on RELIEF method, Open Science Journal [15]. Overcoming resume oversizing and ATS constraints, this paper offers a solution that integrates the Modified Boyer-Moore and RELIEF algorithms. Through resume segmentation into semantic blocks and pattern matching improvement, it enhances CV evaluation accuracy. Future studies can further improve adaptability to resumes in various languages and informal formats.

Investigating the Use of Resume Reviews to Gain Insight into the Skill Sets that Employers Value in Biomedical Engineers, Biomedical Engineering Education [16]. This research investigates the use of resume reviews to gain further insight into what skill sets employers value within Biomedical Engineering. Through the analysis of employer feedback and comparison with what is currently available through existing rubrics, it raises important skill presentation differences between academia and the industry. Future studies could extend to longitudinal skill demand investigations.

Resume Parser Based on Natural Language Processing Approaches, International Journal of Advanced Research in Science, Communication and Technology [17]. The paper suggests a resume parser based on Natural Language Processing (NLP) approaches for automatic data extraction from DOCX and PDF resumes. Based on Python libraries NLTK and SpaCy, it effectively formats extracted data into JSON for analysis. Improvement could extend to semantic analysis to a more deeper level to capture more meaningful data.

Resume Builder: Sophisticated Computational Methods for Professional Growth, Gurukul International Multi-Disciplinary Research Journal [18]. A web resume builder is envisaged, based on the MERN stack, with the ability to offer real-time feedback, ATS compliance, and job market analysis. The system allows users to create professional, customized resumes aligned with prevailing recruitment trends.AI-powered interview preparation assistance can be added in future expansions.

ResumeCraft: A Web Application for Resume Construction Based on Machine Learning, IJRASET [19]. ResumeCraft is a web application that utilizes machine learning to assist the user in developing ATS-friendly resumes with real-time skill detection and keyword matching. Developed with HTML, CSS, and JavaScript, it optimizes the resumes both for recruiters as well as for ATS platforms. Future versions could include suggesting personalized career paths from resume information.Opportunities for Automating Email Processing: A Need-Finding Study, Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems [20] In this paper, opportunities for automation in email processing are discovered using interviews and qualitative data analysis. Prioritization, categorization, and task delegation are some of the challenges mentioned as areas where automation will have a significant impact in lowering cognitive overload and productivity improvement. Future work may investigate AI-based dynamic email workflow optimization.

III. METHODOLOGY

The development of the Intelligent Resume Matching System (IRMS) adopts a multi-phase strategy sensibly crafted for the generation of accurate, effective, and contextualized matching between candidate resumes and job postings. The entire pipeline from data aggregation to feedback output takes advantage of recent breakthroughs in natural language processing (NLP), deep learning, and large language models (LLMs).



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A. Data Collection

It begins by accumulating structured and unstructured data in the resume and job posting format. Resumes were collected from a varied group of contributors including students, professionals, and public datasets. Each resume, stored in PDF format, contains extensive candidate details like education, work experience, skills, certifications, and projects. Job descriptions not only were acquired from online job sites such as LinkedIn, Indeed, and career websites of firms but also included job titles, desired qualifications, desired experience, and technical and soft skills. These are collected for purposes of achieving a comprehensive base for candidate-job matching for industries and experience levels.

B. Data Cleaning and Integration

Data is cleaned correctly as soon as it's collected. PDF resumes are processed using pdfplumber to get raw text, typically marred by formatting issues, excess whitespaces, and special characters. They're tackled using preprocessing tasks such as lowercasing, stop word removal, punctuation removal, and lemmatization.

Advanced Named Entity Recognition (NER) is used to obtain structured data including skills, degree names, companies, and employment dates. Derived statistics like total work experience and latest employment date are calculated using a rule-based parser. Descriptions of jobs undergo the same cleaning and converting step to ensure they are compatible.

The cleaned and organized data is saved in a standard format like CSV or JSON. This makes the downstream components such as matching process and embedding generation operate seamlessly.

C. Embedding Generation and Similarity Computation

To enable semantic comparison of resumes and job ads, both are converted to a dense vector embedding using a pre-trained BERT Sentence Transformer model (all-MiniLM-L6-v2). These 384-dimensional representations capture contextual sense so that more comprehension of the text can be achieved relative to keyword matching.

Cosine similarity is computed for every resume-job description pair. The nearer to 1, the better matches, and worst-matches have lower scores. A cut-off (commonly 0.78) is applied to remove resumes with less than minimum relevant thresholds. This similarity score is used to rank candidates and guide shortlisting decisions for each job posting.

D. LLM-Powered Feedback Generation

A primary characteristic of IRMS is its offering of customized and constructive feedback to candidates. In the case of resumes that are not sufficiently similar, feedback is automatically generated by a Large Language Model (LLM), which has been fine-tuned. The LLM cross-references the resume content of the candidate against the job description and identifies areas for improvement—e.g., missing skills, lack of certifications, or insufficient experience. This feedback is expressed in the format of an email, tailored to the candidate's profile, and includes recommendations such as "Consider AWS certification," or "Provide detailed examples under project experience." Use of an LLM ensures that the recommendations are both linguistically natural, job-specific, and human-sounding in tone. This not only raises transparency but also improves the candidate experience.

E. Model Implementation

The last system is deployed with Python as the main programming language, with several libraries for text processing, embedding generation, and model assessment. After calculating similarity scores between all resumes and a job description, resumes are automatically ranked and shortlisted depending on the set threshold. Rather than using a deployment through a RESTful API, the system employs a direct LLM interaction framework that enables dynamic input and output. The LLM not only generates feedback but also parses complex job descriptions, proposes matching improvements, and answers recruiter or candidate questions. This does away with the need for in-between web services like FastAPI and presents a more chatty and dynamic system design.



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The platform features batch matching functionality where resumes can be uploaded against a single job post. Ranked candidates and their respective scores, extracted skills, and experience years are also viewable by recruiters. Candidates can upload their resumes and receive an immediate Fit Score as well as tips for improvement by email. For optimal performance, embedded computations are accelerated by GPU and batching. Logging and evaluation modules are integrated to monitor average response times, model accuracy (from validation sets), and user interaction statistics. This end-to-end deployment enables a highly competent, scalable, and intelligent resume matching platform that not only automates shortlisting but also humanizes it by offering reflective, actionable feedback—closing the loop on employer needs and candidate readiness.

IV. RESULTS AND DISCUSSIONS

The Intelligent Resume Matching System (IRMS) was applied to three anonymized applicant resumes against a software development job description, using a cosine-similarity cutoff of 50 percent. As summarized in Table 1, each applicant's resume achieved a similarity score exceeding this threshold and was therefore shortlisted. Confirmation emails were dispatched to all three candidates; no feedback emails were generated, since no profiles fell below the set cutoff.

The uniform shortlisting of all three resumes confirms that the 50 percent similarity threshold successfully captures baseline qualifications for the target role. Score variation—63 percent for the best match, down to 51 percent for the worst—highlights the system's capability to discriminate relative fit even within the shortlisted group. Practically, such fineness may help recruiters rank applicants by the extent of congruence to the job specification.

Yet since this is a small sample, the low exclusion rate suggests that a fixed threshold might be nondiscriminatory in larger or more saturated applicant pools. The inclusion of weighted importance of skills (e.g., to prioritize major programming languages over secondary qualifications) or role-specific thresholds would increase selectivity so that highly matched profiles only advance.

Though the feedback loop—powered by an extremely optimized LLM—did not fire in this test, its retention is still valuable for candidate experience. In broader rollouts, personalized advice for rejected candidates will help maintain transparency and enable professional development.

To further enhance IRMS's generalizability in actual hiring contexts, the integration of recruiter feedback mechanisms and hiring success can be a useful training signal for adaptive threshold calibration. Through the analysis of which shortlisted candidates end up passing or securing interviews, or job offers, the system can repeatedly enhance its similarity scoring and feature weighting approach.

This enhancement through feedback enhances not just the precision of candidate match but also the alignment between system and human decision-making behavior, closing the gap between algorithmic recommendation and recruiter instinct. Ultimately, this responsiveness would make IRMS an intensely personalized and sagacious recruitment assistant.

	Lo	gin							
	Email or phone								
	Password								
		Forgot password?							
	La	ogin							
	New to our platf	orm? <u>Register now</u>							
Figure 4-1: Login Page									
Table 1. Sample	e Results								
Applicant <u>Mahideep</u> Tarun Mahideep-VNR	Similarity Score 63 percent 52 percent 49 percent	Shortlisting Shortlisted Shortlisted Not Shortlisted	Notification Sent Confirmation email Confirmation email <u>FeedBack</u> email						

Sample Table1



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HR Dashboard		Dark Mode (+ Logout
	Resume Screening Tool	
	C Resume Matching Select Resume (PDFs):	
	Crag and drop resume files here or click to browse	
	Job Description: Enter the job description here	
	Matching Threshold: Lenient (30)	Strict (90)
	Current Threshold: 50% Q. Process Resumes	
	Figure 4-2 : HR DashBo	ard
HR Dashboard		Dark Mode E+ Logout
	1 (Foc) internet 20 Toto) university 20 A foreignment Feedback (Sec) and university sets and university and the second	•
	Matching Threshold: Lenient (30)	Serier (90)
	Current Threshold: 50%	
	Results Presumes processed successfully	
	Matched Candidates	
	MADASI THARUN KUMAR - VNR.pdf	0% Next Overthand
	Mahldeep_VNR (2).pdf III mahldeepnagireddi@gmail.com	52%
	Mahideep_tcs (1).pdf BB mahideepnagiredd@gmail.com	(GN) Eventure
	3 2 1 3 0 Total Candidates Shortisted Not Shortisted Emails Sent Missing Emails	
		1.

Figure 4-3:Shortlisted Results

	Congratulations! You have been shortlisted Index ×			~	₿.	Z
	jhondoe7001@gmail.com to me ★	20:15 (10 minutes ago)	☆	٢	4	1
	Dear Candidate,					
	You have been shortlisted. Further updates will be shared soon.					
	Best regards, HR Team					
	jhondoe7001@gmail.com tome +	Sat 5 Apr, 10:54	☆	٢	¢	1
	Dear Candidate, Thank you for applying					
Feedback: Your resume reflects a strong focus on backend development and relevant projects. However, it lacks specific asamples of your experience with the MERN stack. Ensure to include de description of your projects that utilize MongoOB and Express pt, as these are crucial for the role Additionally, consider emphasizing your collaborative experiences with UUCX teams Best regards, HR Team						

Figure 4-4:Non-Shortlisted Results

V. CONCLUSIONS AND FUTURE SCOP

This research ventured into designing and developing an Intelligent Resume Matching System (IRMS), utilizing sophisticated natural language processing (NLP) tools and machine learning methods to facilitate efficient shortlisting of resumes. The system commences with obtaining word embeddings of both job postings and resumes via the most innovative technologies, such as pdfplumber to extract PDF content and BERT Sentence Transformer for obtaining semantic embeddings.

By comparing the similarity of the embeddings, the system identifies the resumes that best fit the job requirements. The system uses a user-configurable threshold so that there is room for adjusting the degree of similarity required to tag resumes as shortlisted, thereby allowing the system to be adjusted to varying hiring preferences and requirements.

It is also easier to achieve through automated reminder emails. Instant notifications are provided to shortlisted applicants, making it possible for communication and response to occur much faster. The system provides non-shortlisted applicants with individual feedback emails based on Large Language Models (LLMs). These emails briefly state the possible incompatibilities between the skills of the applicant and requirements of the job and offerAn Automated Resume Screening System Using Natural Language



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Processing and Similarity. constructive criticism to use on future applications. The feedback not only enhances the candidate experience but also aids in the professional growth of the candidates by highlighting areas of improvement.

In total, the IRMS is a gem of innovation in recruitment, promising efficiency and transparency. Through resume shortlisting and feedback, automated by the system, the employer's recruitment process is maximized while the candidate experience is enhanced, giving a better and better-informed job application process.

The Intelligent Resume Matching System can have immense potential for future development in functionality, inclusiveness, and user-friendliness. The system can be augmented with the following functionalities to significantly enhance its capabilities:

A. Multilingual Capability

To facilitate a global talent pool, future expansion may involve multilingual NLP models that can understand and process resumes and job descriptions across several regional and global languages. This enables recruiters to tap into diverse talent and allows for unbiased hiring that transcends geographic boundaries. Utilizing pretrained models such as mBERT or XLM-Roberta would allow semantic matching outside of English, thus eliminating language barriers in talent attraction.

B. Bias Detection and Mitigation

As recruitment processes increasingly depend on equity and fairness, the mechanism can be augmented with bias detection features to verify and prevent potential gender, ethnicity, or age bias. Algorithms applied to NLP with a sense of justice will validate resume matching solely on merit. Ongoing auditing and use of de-biasing protocols during training and embedding generation will validate ethics in the hiring process.

C. Voice Input for Job Descriptions

For the sake of enhancing usability and reducing manual work of entry, the site can include voice-to-text functionality to allow recruiters to describe job requirements verbally. Such functionality would use speech-to-text APIs (i.e., Google Speech-to-Text or Whisper) to convert spoken words into organized text, thus improving the usability of the platform, especially for visually impaired or non-technical users.

D. Interactive Visual Dashboard for Decision Support

An intuitive, real-time dashboard can be brought in to visually display matching scores, candidate rankings, gap analysis, and filtering metrics. It would enable recruiters to easily interpret and contrast levels of candidate fit through graphs, heatmaps, and skill-match visualizations. A dynamic UI increases transparency in the decision process and enables recruiters with actionable insights throughout talent assessment.

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