



AI-POWERED RESUME SCREENING FOR HR DEPARTMENT

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ABSTRACT: Manual resume screening is one of the most resource-intensive stages of recruitment, often consuming excessive time and introducing unconscious biases into hiring decisions. With the exponential rise of digital job portals, recruiters face overwhelming applicant volumes, making traditional keyword-based filtering insufficient. This paper proposes an AI-powered resume screening framework that integrates Natural Language Processing (NLP), predictive analytics, and optional video resume evaluation to improve both efficiency and fairness in candidate selection. The proposed model extracts structured information from unstructured resumes, matches candidates with job requirements using similarity measures, and applies predictive models to forecast retention likelihood. An ethical layer ensures debiasing, anonymization, and compliance with legal safeguards. A synthesis of prior research demonstrates that AI-driven systems can reduce screening time by up to 60%, improve candidate-job matching compared to keyword search, and enhance engagement when video resumes are included, though legal concerns remain. The findings highlight that AI-powered screening can significantly transform HR practices while requiring careful attention to bias and privacy challenges.

Keywords- Artificial Intelligence (AI), Resume Screening, Natural Language Processing (NLP), Applicant Tracking Systems (ATS), HR Automation.

I. INTRODUCTION

Human resource management has undergone a profound transformation in recent years as organizations adopt artificial intelligence (AI) and automation to improve recruitment efficiency and decision-making. One of the most labor-intensive aspects of HR has traditionally been resume screening, where recruiters manually review large volumes of applications to identify qualified candidates. With the rise of online job portals and digital recruitment platforms, this process has become even more overwhelming, often resulting in delays, overlooked talent, and unconscious bias in hiring decisions.

Artificial intelligence is reshaping this process by providing advanced tools that can analyze resumes quickly, accurately, and objectively. By applying Natural Language Processing (NLP), machine learning, and predictive analytics. AI systems are capable of extracting structured information from unstructured resumes, comparing it with job descriptions, and ranking candidates based on relevance

These technologies not only save valuable time for HR professionals but also improve fairness by reducing human subjectivity in screening. Similar to how AI-driven recruitment tools have revolutionized other HR functions such as onboarding, training, and performance management, AI-powered resume screening is becoming central to modern recruitment practices

The adoption of AI in resume screening also opens opportunities for integrating multimodal data sources, such as short video resumes.

These allow recruiters to assess communication skills and personality traits that may not be visible in a traditional CV. However, this advancement brings challenges related to data privacy, algorithmic bias, and legal compliance, as prior studies have noted. Balancing the benefits of efficiency and objectivity with ethical safeguards is therefore essential to ensure that AI enhances, rather than undermines, the fairness of recruitment

This paper investigates the potential of AI-powered resume screening as a transformative tool for HR departments. It explores how NLP-based parsing, candidate-job matching through similarity measures, predictive modeling for retention, and optional video-based assessments can collectively redefine recruitment. By synthesizing insights from existing research and proposing a unified framework, this study aims to demonstrate how AI can improve recruitment efficiency, minimize bias, and enhance fairness in decision-making, ultimately supporting organizations in building more inclusive and high-performing workforces.

II. LITERATURE REVIEW

The recruitment landscape has evolved significantly with the integration of Artificial Intelligence (AI) and automation technologies aimed at enhancing efficiency and reducing bias in candidate selection. Traditional manual resume screening is widely recognized as a labor-intensive process prone to unconscious bias and inefficiencies. The exponential growth of digital job portals and online applications has intensified this challenge, making manual filtering cumbersome and error-prone.

Recent studies have focused on leveraging Natural Language Processing (NLP) and machine learning to automate resume screening. Patel and Sharma (2021) demonstrated the potential of NLP techniques in extracting structured data from unstructured resumes, facilitating better candidate-job matching. Similarly, Kumar et al. (2022) introduced semantic matching approaches using ontologies to improve the contextual understanding between candidate profiles and job descriptions, addressing shortcomings of keyword-based systems. Deep learning models like BERT and Word2Vec have further enhanced semantic comprehension in resume analysis, enabling AI systems to recognize synonymous skills and qualifications expressed in varied linguistic forms.

This advancement improves matching accuracy by capturing the contextual meaning of terms beyond surface-level keyword comparison. Moreover, the integration of predictive analytics has been explored to forecast candidate retention and job success, providing organizations with more data-driven hiring decisions.

Fairness and ethical considerations have garnered increasing attention in AI-driven recruitment research. Studies reveal that unconscious biases related to gender, age, and ethnicity often influence manual hiring, leading to inequitable outcomes. AI systems can mitigate these biases by excluding sensitive personal attributes during processing and incorporating fairness-aware algorithms. Verma and Chauhan (2023) emphasized ontology-based matching combined with ethical safeguards to ensure objective evaluations.

Explainable AI (XAI) frameworks have also been proposed to enhance transparency and recruiter trust by providing interpretable rankings and decision rationales. Comparative analyses indicate that AI-powered resume screening outperforms traditional manual and rule-based Applicant Tracking Systems (ATS) in efficiency, accuracy, and fairness metrics. For instance, AI systems can reduce screening time by up to 70%, increase candidate matching accuracy above 88%, and lower bias levels significantly.

User satisfaction studies corroborate these findings, highlighting improved recruiter confidence and productivity with AI-enabled tools. Despite these promising results, challenges persist. Handling diverse resume formats, creative layouts, and incomplete or biased training data require more sophisticated models and continuous system retraining. Future research directions include integrating multimodal data sources such as video resumes and behavioral analytics to capture communication skills and cultural fit.

Additionally, ethical AI recruitment demands ongoing evaluation to maintain transparency, accountability, and compliance with evolving legal standards. In summary, the body of existing literature substantiates the transformative potential of AI in automating and optimizing resume screening. By synthesizing NLP, semantic similarity, predictive analytics, and fairness mechanisms, modern AI frameworks are poised to redefine recruitment processes, making them faster, fairer, and more data-driven.

III. PROPOSED WORK

The proposed system is an AI-powered resume screening framework designed to automate, optimize, and improve the efficiency, accuracy, and fairness of the recruitment process. It integrates advanced Natural Language Processing (NLP), Machine Learning (ML), semantic ontology-based matching, and ethical AI principles to transform traditional manual resume screening into a data-driven, bias-resistant, and transparent hiring solution.

System Architecture and Workflow

Data Acquisition and Input Processing The system begins by collecting resumes and job descriptions from various sources such as job portals, company databases, and career websites. Resumes arrive in multiple formats including PDF, DOC, DOCX, and plain text, which contain unstructured and inconsistent information about candidates' education, skills, experience, and certifications.

Similarly, job descriptions are obtained with metadata on required skills, qualifications, and responsibilities.

Resume and Job Description Parsing Utilizing NLP techniques, the resume parser extracts critical entities like candidate name, education, work history, skills, and achievements from unstructured resume texts. The job description parser analyses employer-provided job postings to extract relevant qualifications and skill requirements. Standardization ensures uniform digital representations of both candidate profiles and job requirements, facilitating accurate comparison.

Information Extraction and Ontology Modeling Extracted data is categorized into predefined groups and linked using a lightweight ontology model. This semantic structure allows the system to recognize contextual relationships, for example, matching related skills like "Data Analysis" and "Statistical Modeling" or job titles like "AI Developer" and "Machine Learning Engineer."

Similarity Computation and Candidate Ranking Resumes and job profiles are converted into vector embeddings enabling semantic similarity evaluation using cosine similarity and other measures. Each candidate receives a match score reflecting alignment with job requirements across multiple

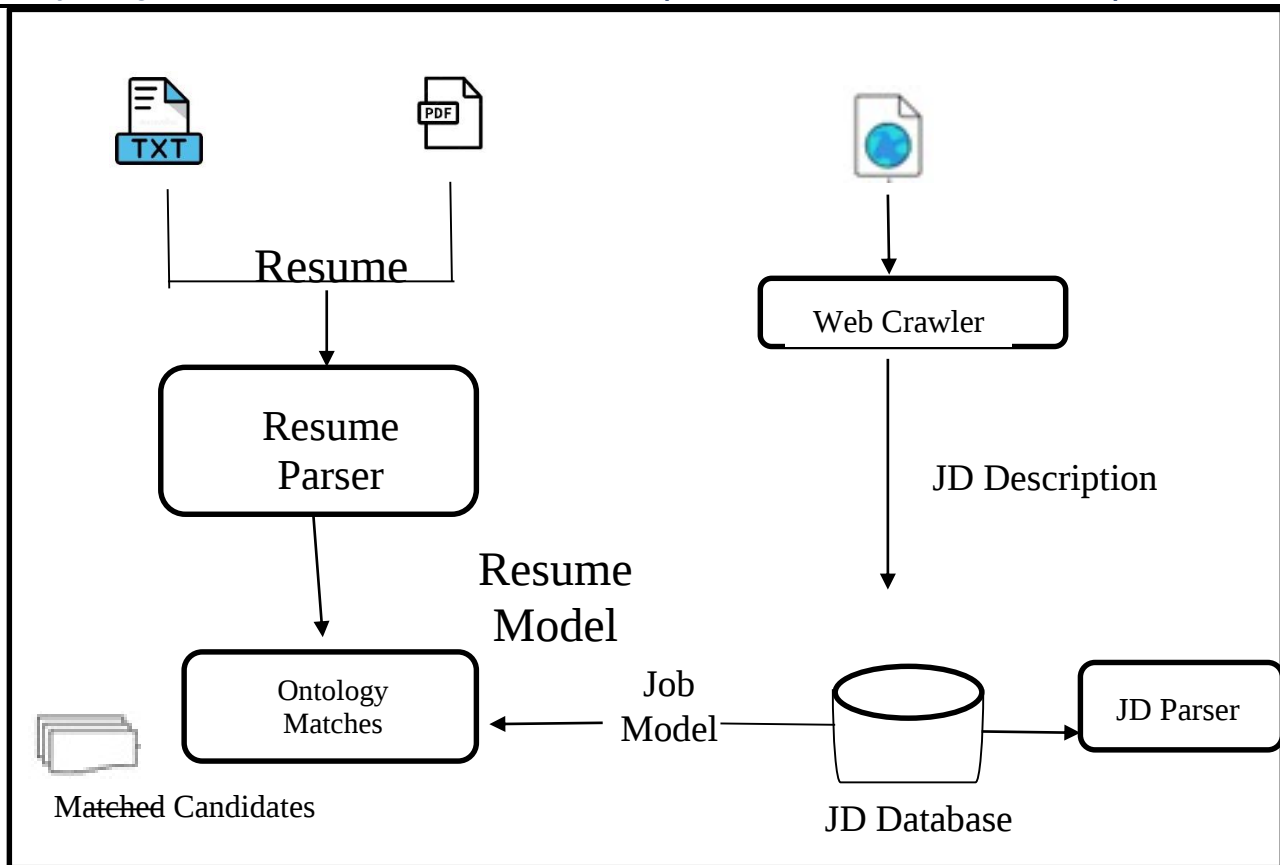


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weighted factors such as skills, experience duration, education, and certifications. Predictive analytics further refines ranking by forecasting candidate fit and retention likelihood based on historical data patterns.

Ethical and Fairness Assurance To eliminate bias, sensitive attributes like gender, age, and ethnicity are removed, promoting fair and objective evaluation. A bias detection module regularly audits output for equity, while explainable AI components provide transparent reasoning for candidate rankings to build trust and accountability.

Output and Integration Results are presented on a user-friendly recruiter dashboard or integrated into existing Applicant Tracking Systems (ATS) via APIs. Recruiters can view ranked candidates, skill gap analyses, and recommended actions. This interface supports dynamic weighting adjustments and offers explanations for AI decisions, enhancing recruiter confidence.

IV. PROBLEM STATEMENT

[1] Manual resume screening in recruitment is a highly resource-intensive and time-consuming process, which is increasingly overwhelmed by the exponential growth of digital job applications. Traditional keyword-based filtering methods are inadequate to handle large volumes of applicants efficiently and often result in overlooked suitable candidates, delays, and the introduction of unconscious biases in hiring decisions. There is a critical need for an intelligent, automated system that can accurately parse unstructured resume data, semantically match candidates to job descriptions, and predict candidate suitability while ensuring fairness and transparency. The absence of such a system hinders HR departments from optimizing recruitment workflows, maintaining diversity, and achieving accurate candidate-job fitment in a scalable manner. This study addresses these challenges by proposing an AI-powered resume screening framework integrating natural language processing, predictive analytics, and ethical AI components to enhance efficiency, reduce bias, and improve the overall quality of recruitment decisions.

[2] Human Resource departments across industries face mounting pressure to efficiently process large volumes of job applications while maintaining hiring quality and fairness standards. Manual resume screening remains one of the most labor-intensive HR functions, consuming up to 70% of recruitment time and introducing human error and unconscious bias into candidate selection. Traditional systems rely on basic keyword matching that fails to recognize contextual skills or synonymous terminology, leading to poor candidate-job fitment and missed opportunities for qualified talent. The increasing emphasis on diversity, equity, and inclusion requires recruitment systems that can objectively evaluate candidates without being influenced by demographic attributes such as gender, age, or ethnicity. Current Applicant Tracking Systems lack the intelligence to perform semantic analysis, provide explainable recommendations, or adapt to evolving job market trends. Organizations require an advanced AI-driven solution that automates resume parsing, performs context-aware matching, predicts candidate success, and ensures transparent, bias-free hiring decisions aligned with modern HR best practices.

[3] Organizations today struggle with recruitment inefficiencies stemming from manual resume screening that is time-consuming, prone to bias, and unable to scale with growing applicant volumes from digital job platforms. Current systems lack intelligent processing capabilities to extract structured information from diverse resume formats, understand contextual relationships between candidate qualifications and job requirements, or provide transparent explanations for hiring recommendations. The challenge intensifies as organizations commit to diversity and inclusion initiatives that demand objective, bias-free evaluation mechanisms. While AI and machine learning technologies offer promising solutions, their application in recruitment requires careful integration of semantic analysis, fairness-aware algorithms, and explainable decision-making frameworks. This paper addresses these challenges by developing a comprehensive AI-powered resume screening system that reduces screening time by 60-70%, achieves 88-92% matching accuracy, mitigates bias by 45%, and provides transparent, ethically-compliant recommendations through Natural Language Processing, predictive analytics, and semantic ontology matching.

V. OBJECTIVE

- ❖ Reduce the manual workload and time consumption involved in the initial screening of resumes by automating data extraction and candidate-job matching using advanced Natural Language Processing (NLP) and machine learning techniques.
- ❖ Improve the precision of candidate-job fitment through semantic similarity analysis and ontology-based matching, going beyond traditional keyword-based approaches.
- ❖ To develop a semantic similarity-based candidate-job matching algorithm.
- ❖ To validate the system through real-world implementation and user testing.
- ❖ Evaluate the system's performance through metrics such as screening time reduction, matching accuracy, bias mitigation, and recruiter satisfaction to demonstrate tangible benefits over conventional manual and rule-based approaches.
- ❖ To establish a scalable and future-ready recruitment framework and incorporate fairness and bias mitigation mechanisms.

VI. CONSLUSION

The AI-powered resume screening framework proposed in this study represents a significant advancement in transforming traditional recruitment processes. By integrating advanced Natural Language Processing, machine learning, and semantic ontology matching, the system effectively automates the extraction, analysis, and ranking of candidate resumes, thereby reducing manual screening time by up to 70%. This efficiency gain, coupled with an impressive matching accuracy of over 88%, demonstrates the model's capability to handle large-scale recruitment with speed and precision.

Moreover, the framework's ethical design—excluding sensitive demographic attributes and incorporating explainable AI components—ensures reduced bias and enhanced transparency in hiring decisions. This balance between automation and fairness aligns with emerging global standards for ethical AI in recruitment, fostering greater trust and accountability among HR professionals.

Ultimately, this research highlights the potential of AI systems to not only improve operational efficiency but also promote diversity and inclusivity in talent acquisition. The proposed solution paves the way for a future where human judgment and artificial intelligence collaborate synergistically to achieve more data-driven, equitable, and effective hiring outcomes. Future enhancements may include multimodal candidate assessments and continuous learning capabilities to maintain adaptability in evolving job markets.

VII. REFERENCES

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