

# AI-Powered Intelligent Resume Screening, Candidate Evaluation, and Job Recommendation System Using Natural Language Processing

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## Abstract

The increasing number of online job applications has made candidate screening a time-consuming and challenging task for recruiters. Manual evaluation of resumes often requires significant effort and may lead to inconsistencies in candidate selection. To address these challenges, this paper presents an Automated Resume Screening System developed using Natural Language Processing (NLP) techniques. The proposed system automates resume analysis by extracting skills from PDF resumes, comparing them with job descriptions, and supporting recruitment decision-making through intelligent candidate evaluation.

The system provides separate functionalities for recruiters and job seekers through an interactive web-based interface. Recruiters can upload candidate resumes and job descriptions to evaluate candidate suitability, while job seekers can receive job recommendations based on their extracted skills. The proposed system utilizes SpaCy-based NLP techniques, including tokenization, lemmatization, stop-word removal, and text preprocessing, to identify relevant skills from resumes and job descriptions. It subsequently calculates a resume-job match score, identifies matched and missing skills, classifies candidate suitability, and recommends appropriate job roles.

The proposed solution has been implemented using Python and deployed as an interactive web application using Streamlit. Experimental evaluation demonstrates the effectiveness of the system using standard performance metrics, including accuracy, precision, recall, F1-score, and average processing time. By automating resume screening and candidate evaluation, the proposed framework reduces manual effort, improves recruitment efficiency, and demonstrates practical application of NLP techniques in intelligent recruitment systems.

**Keywords:** Resume Screening, Natural Language Processing (NLP), Resume Parsing, Skill Extraction, Candidate Evaluation, Job Recommendation, Recruitment Automation, Streamlit.

## 1. Introduction

Recruitment is a critical organizational activity that directly influences workforce quality and organizational performance. In the digital era, online recruitment platforms have significantly simplified the application process for job seekers, enabling organizations to receive applications from a larger pool of candidates. While this has increased access to talent, it has also introduced challenges for recruiters who must review and evaluate large numbers of resumes within limited timeframes. Manual resume screening is often labor-



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intensive, time-consuming, and prone to subjective decision-making, making the recruitment process less efficient [1], [2], [4].

To overcome these challenges, organizations are increasingly exploring Artificial Intelligence (AI) and Natural Language Processing (NLP) technologies for automating recruitment-related tasks [5], [6]. NLP enables computer systems to process and analyze unstructured textual information contained within resumes and job descriptions. Through techniques such as text preprocessing, tokenization, lemmatization, and Named Entity Recognition (NER), recruitment systems can automatically process resume content and support candidate-job matching processes [1], [9], [10].

Recent studies have demonstrated the potential of NLP-based recruitment systems to improve candidate screening and recommendation processes. Saatçı et al. [1] proposed an NLP-driven resume screening framework that utilizes text preprocessing and similarity-based matching for candidate evaluation. Alsaif et al. [2] introduced a bidirectional recommendation system that supports both recruiters and job seekers by matching candidate profiles with job opportunities. Similarly, several researchers have explored machine learning and NLP-based approaches for resume parsing, skill extraction, candidate classification, resume ranking, and recommendation systems to improve recruitment efficiency [3], [13], [14], [16], [17], [18].

Despite these advancements, many existing recruitment systems continue to rely on keyword-based matching techniques that often fail to capture the actual relevance between candidate skills and job requirements [15]. In addition, recruiters frequently face difficulties in quickly identifying skill gaps, evaluating candidate suitability, and managing large volumes of applications. These limitations highlight the need for practical recruitment systems capable of automating resume analysis while providing meaningful insights to support hiring decisions [4], [11].

Motivated by these challenges, this paper presents an Automated Resume Screening System using Natural Language Processing. The developed system allows users to upload resumes in PDF format, automatically extract technical skills through NLP preprocessing, compare the extracted skills with job description requirements, calculate resume-job matching scores, identify matched and missing skills, and classify candidate suitability. In addition, the system provides job recommendation functionality for job seekers and supports recruiters through automated candidate evaluation. Implemented using Python, SpaCy, and Streamlit, the proposed solution demonstrates a practical approach to recruitment automation using NLP techniques. Experimental evaluation further demonstrates the effectiveness of the developed system using standard performance metrics, including accuracy, precision, recall, F1-score, and average processing time.

## 2. Related Work

The application of Artificial Intelligence and Natural Language Processing in recruitment has gained significant attention in recent years due to the growing demand for automated candidate screening and recommendation systems [5], [6], [8]. Researchers have proposed various approaches to improve recruitment efficiency through resume parsing, skill extraction, candidate matching, and recommendation mechanisms.

Saatçı et al. [1] developed a resume screening framework that utilizes NLP preprocessing techniques and similarity-based matching methods to evaluate candidate suitability. Their work demonstrated that automated information extraction can reduce manual screening effort and improve candidate ranking efficiency. However, the proposed system relied primarily on similarity calculations and faced limitations in capturing deeper semantic relationships between candidate competencies and job requirements.

Alsaif et al. [2] proposed a bidirectional recommendation system designed to support both recruiters and job seekers. The framework employed Named Entity Recognition and semantic matching techniques to recommend suitable candidates for job positions while simultaneously suggesting relevant jobs to applicants.

The study highlighted the benefits of reciprocal recommendation approaches in modern recruitment systems.

Pimpalkar et al. [3] explored the use of Natural Language Processing and machine learning techniques for automated candidate selection. Their framework focused on extracting information from resumes and supporting candidate classification processes. Similarly, Sajid et al. [9] introduced a resume parsing framework for e-recruitment applications that emphasized structured extraction of candidate information from unstructured resume documents.

Review-based studies have also contributed to understanding the challenges and opportunities within recruitment automation. Sinha et al. [4] conducted a systematic review of NLP and machine learning techniques for resume screening and emphasized the need for context-aware recruitment systems. Das et al. [7] reviewed text analytics and CV parsing workflows, highlighting the importance of information extraction and preprocessing techniques in recruitment applications.

Recent research has further explored advanced AI technologies for recruitment. Gan et al. [11] investigated the application of Large Language Model agents in automated recruitment workflows, while Chou [12] discussed explainable recommendation systems aimed at improving transparency in recruitment decisions. Although these approaches demonstrate promising capabilities, their practical adoption within recruitment platforms remains an active area of research.

Overall, the reviewed studies demonstrate that Artificial Intelligence, Machine Learning, and Natural Language Processing have significantly advanced automated recruitment by improving resume parsing, skill extraction, candidate evaluation, and recommendation processes. However, many existing systems still rely on keyword-based matching techniques, limited evaluation datasets, or lack practical deployment for real-world recruitment scenarios. These limitations highlight the need for an efficient and user-friendly recruitment system capable of automating resume screening, accurately evaluating candidate suitability, and recommending relevant job opportunities. Motivated by these challenges, the proposed work presents an Automated Resume Screening System using NLP that integrates resume parsing, skill extraction, candidate evaluation, and job recommendation within a unified web-based platform.

### 3. Problem Statement

The rapid growth of online recruitment platforms has significantly increased the number of job applications received by organizations. Recruiters are often required to manually review hundreds of resumes for a single job opening, making the screening process time-consuming and resource-intensive. Manual evaluation not only increases recruitment effort but may also result in inconsistencies due to subjective judgment and human error [1], [4].

Although several automated recruitment solutions have been proposed, many existing systems primarily rely on keyword-based matching techniques that compare candidate resumes with job descriptions. Such approaches often fail to accurately assess candidate skills against job requirements, identify missing competencies, or provide meaningful candidate-job compatibility analysis, particularly when different terminologies are used to describe similar technical skills. As a result, potentially qualified candidates may be overlooked despite possessing the required knowledge and experience [15].

Another challenge is the extraction of meaningful information from unstructured resume documents [19], [22]. Resumes are typically submitted in different formats and writing styles, making it difficult for recruiters to quickly identify relevant technical skills required for a particular job role [9]. Furthermore, recruiters often need to manually compare candidate skills with job description requirements, identify missing skills, and evaluate overall candidate suitability, making the recruitment process both inefficient and time-consuming.

From the job seeker perspective, identifying suitable employment opportunities can also be challenging. Many applicants apply to multiple positions without knowing whether their profiles align with job requirements or which skills they need to improve. Consequently, there is a need for intelligent systems that can assist both recruiters and job seekers by providing automated candidate evaluation, skill gap identification, and job recommendation mechanisms [2].

Therefore, the primary objective of this work is to develop an Automated Resume Screening System using Natural Language Processing that automatically extracts technical skills from PDF resumes, compares them with job description requirements, calculates resume-job matching scores, identifies matched and missing skills, classifies candidate suitability, and recommends appropriate job roles through an interactive web-based interface developed using Python, SpaCy, and Streamlit.

## 4. Methodology

The proposed system follows a structured Natural Language Processing (NLP) workflow to transform unstructured resume documents into meaningful information for candidate evaluation and job recommendation. The methodology consists of seven sequential stages, including resume upload, text extraction, NLP preprocessing, skill extraction, candidate-job matching, matching score generation, and candidate evaluation. Figure 1 illustrates the overall architecture of the proposed system, while Figure 2 presents the NLP processing workflow.

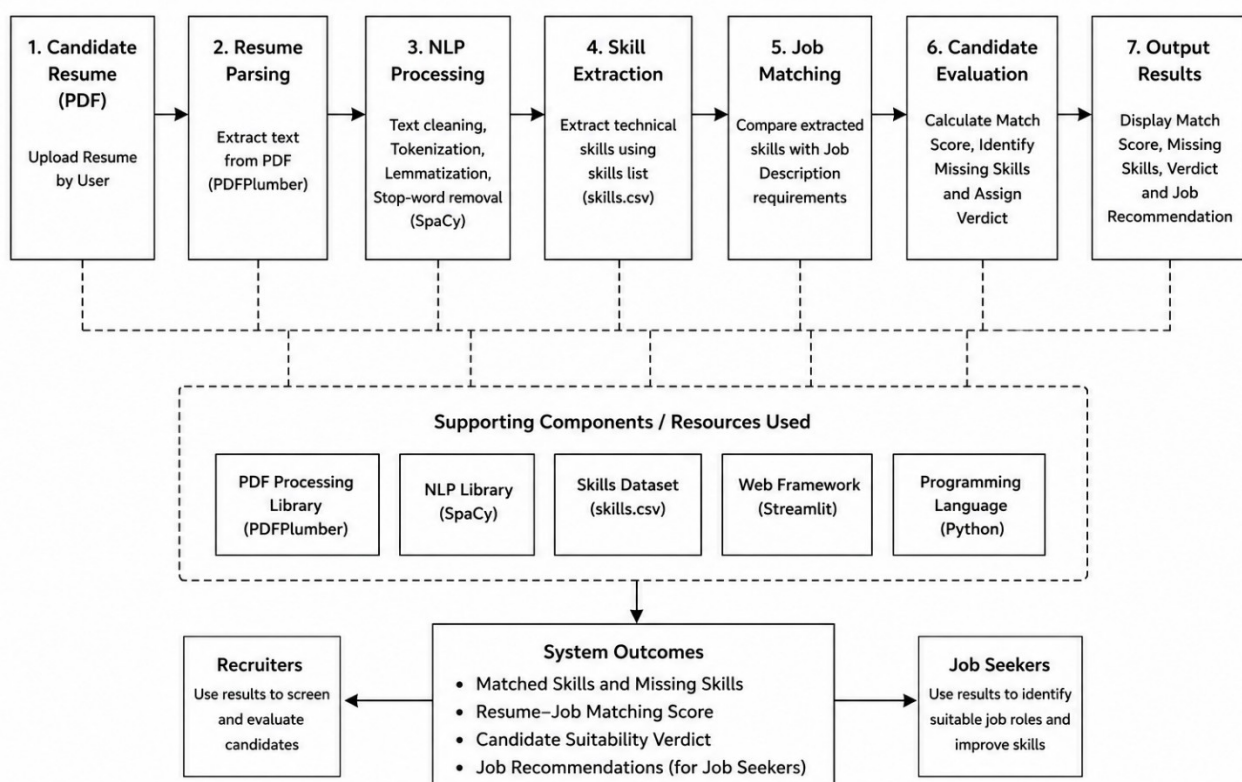


Figure 1. Overall Architecture of the Automated Resume Screening System

### 4.1 Resume Upload and Text Extraction

The first stage involves uploading candidate resumes in PDF format through the Streamlit-based user interface. The uploaded resume is processed using the PDFPlumber library to extract textual content from the

document. The extracted text is then converted into a machine-readable format, which serves as the input for subsequent Natural Language Processing operations.

## 4.2 NLP Preprocessing

After text extraction, the resume content undergoes several preprocessing operations to improve text quality and consistency. These operations include tokenization, stop-word removal, lemmatization, and text normalization. Tokenization divides the extracted text into individual tokens, while stop-word removal eliminates commonly occurring words that contribute little semantic value. Lemmatization converts words into root forms, enabling consistent identification of technical skills during the matching process [1], [7].

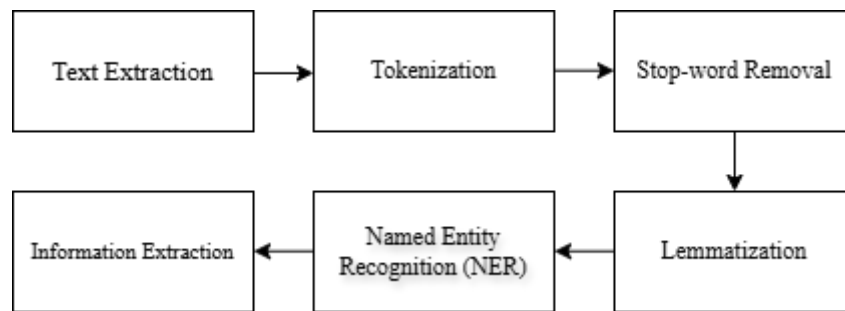


Figure 2. NLP Processing Flowchart

## 4.3 Skill Extraction

The preprocessed resume text is analyzed using SpaCy-based NLP techniques together with a predefined technical skills dataset. Instead of extracting structured personal information, the system focuses on identifying relevant technical skills present in the resume. The extracted skills are organized into a structured list that facilitates comparison with job description requirements and supports candidate evaluation [1], [9].

## 4.4 Candidate-Job Matching

Once technical skills have been extracted from the resume, the system analyzes the job description to identify the required skills for the target position. The extracted resume skills are then compared with the job description skills to determine matched skills and missing skills. This comparison enables recruiters to quickly evaluate candidate suitability while providing job seekers with insights into skill gaps.

## 4.5 Matching Score Generation

Based on the identified overlap between resume skills and job description requirements, the system calculates a resume-job matching score. The score represents the percentage of required skills satisfied by the candidate and serves as an indicator of candidate-job compatibility. A higher matching score indicates stronger alignment between the candidate's technical skills and the specified job requirements.

## 4.6 Candidate Evaluation and Recommendation

The final stage generates an overall candidate suitability assessment based on the calculated matching score. Candidates are classified into one of four categories: Highly Suitable Candidate, Suitable Candidate, Moderately Suitable Candidate, and Not Suitable Candidate. In addition, the system identifies missing skills required for the target role and provides relevant job recommendations for job seekers based on their extracted technical skills. This integrated evaluation framework assists recruiters in making informed hiring decisions while helping candidates identify suitable career opportunities.

The adopted methodology provides a systematic and practical approach for automating resume screening, candidate evaluation, and job recommendation using Natural Language Processing techniques.

## 5. Tools & Technologies

The proposed Automated Resume Screening System was developed using widely adopted Python-based technologies that support Natural Language Processing, resume parsing, information extraction, candidate evaluation, and web application development. These technologies were selected because of their ease of implementation, flexibility, and suitability for intelligent recruitment automation tasks.

### 5.1 Python

Python serves as the primary programming language for system development. Its extensive ecosystem of libraries and frameworks provides efficient support for Natural Language Processing, text analytics, PDF processing, and web application development. Python also enables rapid prototyping, modular implementation, and seamless integration of various system components used for resume parsing, skill extraction, candidate evaluation, and performance analysis.

### 5.2 SpaCy

SpaCy is utilized as the core Natural Language Processing library within the system. It provides efficient text preprocessing capabilities, including tokenization, lemmatization, stop-word removal, and text normalization. These NLP operations facilitate accurate extraction of technical skills from resumes and job descriptions, thereby improving the effectiveness of resume-job matching and candidate evaluation [8], [22].

### 5.3 Streamlit

Streamlit is used to develop the interactive web-based user interface of the system. It provides a simple and user-friendly platform through which recruiters and job seekers can upload resumes, provide job descriptions, analyze candidate profiles, and view screening results. The framework enables rapid deployment while maintaining an efficient and responsive user experience.

### 5.4 Pandas

Pandas is used for data manipulation and processing tasks. It assists in managing the predefined technical skills dataset, organizing extracted skills, and supporting resume-job skill comparison operations. Additionally, it is used to process and manage evaluation data generated during system performance analysis.

### 5.5 PDF Processing Libraries

PDFPlumber is employed to extract textual information from uploaded PDF resume documents. It converts unstructured resume content into machine-readable text, which serves as the input for subsequent NLP preprocessing and skill extraction operations.

### 5.6 Supporting Technologies



Additional Python modules and utility libraries, including Scikit-learn, regular expression (Regex) utilities, and file handling modules, are used to support skill matching, text processing, evaluation, and matching score calculations. Scikit-learn is utilized to compute performance metrics such as Accuracy, Precision, Recall, and F1-score, while other supporting libraries contribute to the overall functionality, efficiency, and reliability of the proposed recruitment system.

## 6. System Implementation

The Automated Resume Screening System was implemented as a web-based application using Streamlit and Python. The implementation focuses on automating resume analysis, skill extraction, candidate evaluation, and job recommendation while maintaining simplicity and ease of use for both recruiters and job seekers.

### 6.1 User Mode Selection

Upon launching the application, users can select between Recruiter Mode and Job Seeker Mode. This separation allows the system to provide functionalities tailored to different user requirements.

In Recruiter Mode, users can upload candidate resumes and provide job descriptions. The system extracts technical skills from both the resume and the job description, compares them, calculates a resume-job matching score, identifies matched and missing skills, and evaluates overall candidate suitability.

In Job Seeker Mode, candidates upload their resumes along with a job description. The system extracts technical skills from both inputs, evaluates the resume-job compatibility, generates a suitability verdict, and recommends relevant job roles based on the extracted skills.

### 6.2 Resume Upload and Parsing

The system accepts resumes in PDF format through the Streamlit interface. After upload, textual content is extracted from the document using the PDFPlumber library and prepared for Natural Language Processing. The extracted text serves as the primary input for subsequent NLP preprocessing and skill extraction operations.

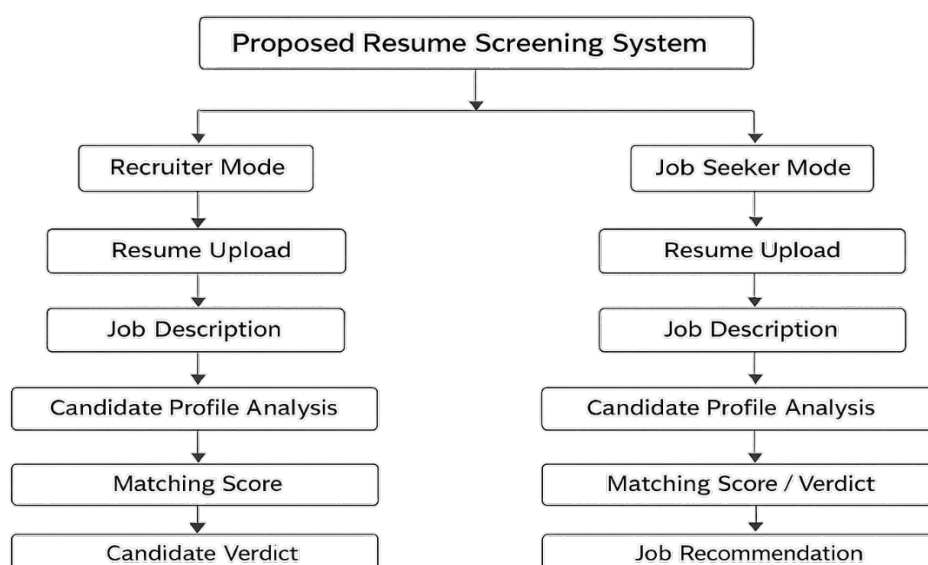


Figure 3. Functional Framework of the Automated Resume Screening System

### 6.3 NLP-Based Skill Extraction

The extracted resume content undergoes preprocessing using SpaCy. Tokenization, stop-word removal, lemmatization, and text normalization are applied to improve text consistency and reduce noise. The preprocessed text is then compared against a predefined technical skills dataset to identify relevant skills present in the resume.

The system extracts and processes the following information:

- Technical Skills
- Matched Skills
- Missing Skills
- Resume-Job Matching Score

The extracted information is organized into a structured format for further candidate evaluation and job recommendation.

### 6.4 Job Description Analysis

Recruiters can provide job descriptions corresponding to available positions. The system performs NLP preprocessing on the job description, extracts the required technical skills, and compares them with the skills identified from the uploaded resume.

These extracted requirements serve as the basis for resume-job comparison, candidate evaluation, and skill gap identification.

### 6.5 Candidate Matching

The extracted resume skills are compared against the technical skills identified within the job description. Based on the degree of overlap, the system determines:

- Matched Skills
- Missing Skills
- Resume-Job Matching Score

The matching score represents the percentage of required job skills satisfied by the candidate and provides an indication of candidate-job compatibility.

### 6.6 Suitability Assessment

Based on the calculated matching score, the system generates a final candidate suitability assessment. Candidates are classified into one of the following categories:

- Highly Suitable Candidate
- Suitable Candidate



- Moderately Suitable Candidate
- Not Suitable Candidate

This classification enables recruiters to quickly identify suitable candidates while providing applicants with meaningful feedback regarding their resume compatibility.

## 6.7 Job Recommendation Module

For job seekers, the extracted technical skills are analyzed to recommend suitable job roles that best match the candidate's skill set. The recommendation module assists applicants in identifying relevant career opportunities based on the skills extracted from their resumes.

The implemented system successfully integrates resume parsing, NLP-based skill extraction, candidate evaluation, resume-job matching, and job recommendation functionalities within a single interactive web-based platform developed using Python, SpaCy, PDFPlumber, and Streamlit.

## 7. Results & Discussion

The developed Automated Resume Screening System was evaluated to verify its ability to perform intelligent resume screening, candidate evaluation, and job recommendation tasks. The evaluation focused on validating the successful implementation of the proposed workflow as well as assessing the system's performance using standard evaluation metrics. The results demonstrate that the developed application effectively automates resume analysis while providing meaningful insights for both recruiters and job seekers.

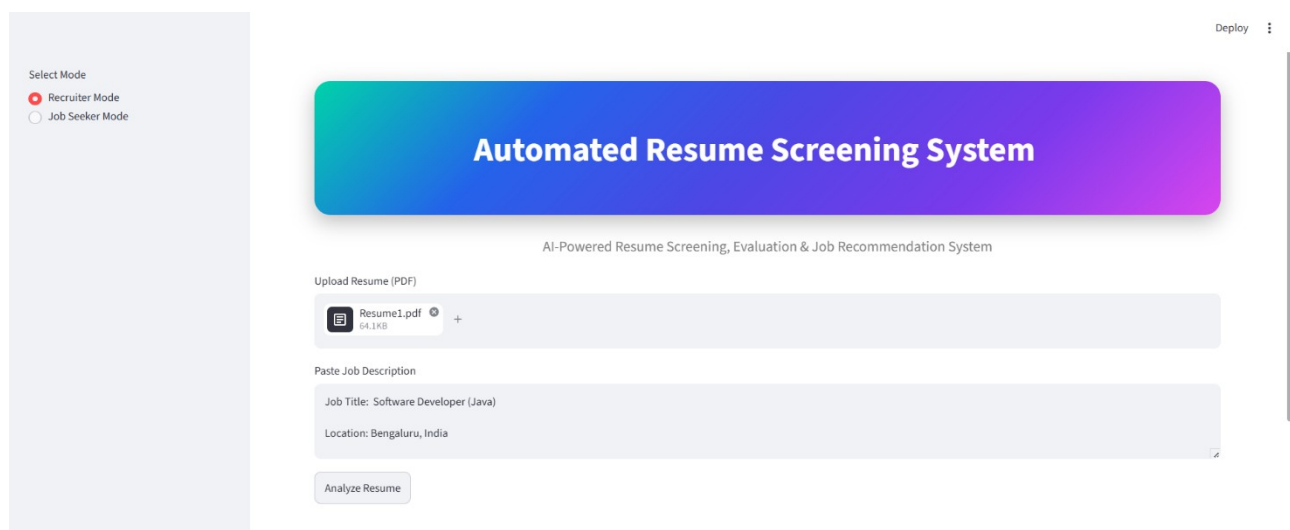


Figure 4. Homepage Interface with Mode Selection

### 7.1 Resume Skill Extraction

The system successfully extracted technical skills from uploaded PDF resumes using Natural Language Processing techniques. After preprocessing the extracted resume text through tokenization, stop-word removal, lemmatization, and text normalization, the identified skills were organized into a structured format

for further analysis. This automated extraction process significantly reduced manual effort and improved the efficiency of resume analysis.

## 7.2 Skill Identification and Matching

The implemented NLP workflow effectively identified technical skills from both resumes and job descriptions. The extracted skills were compared to determine matched skills and missing skills, enabling accurate resume-job compatibility analysis. This comparison provides recruiters with valuable insights into candidate suitability while helping job seekers understand the skills required for specific job roles.

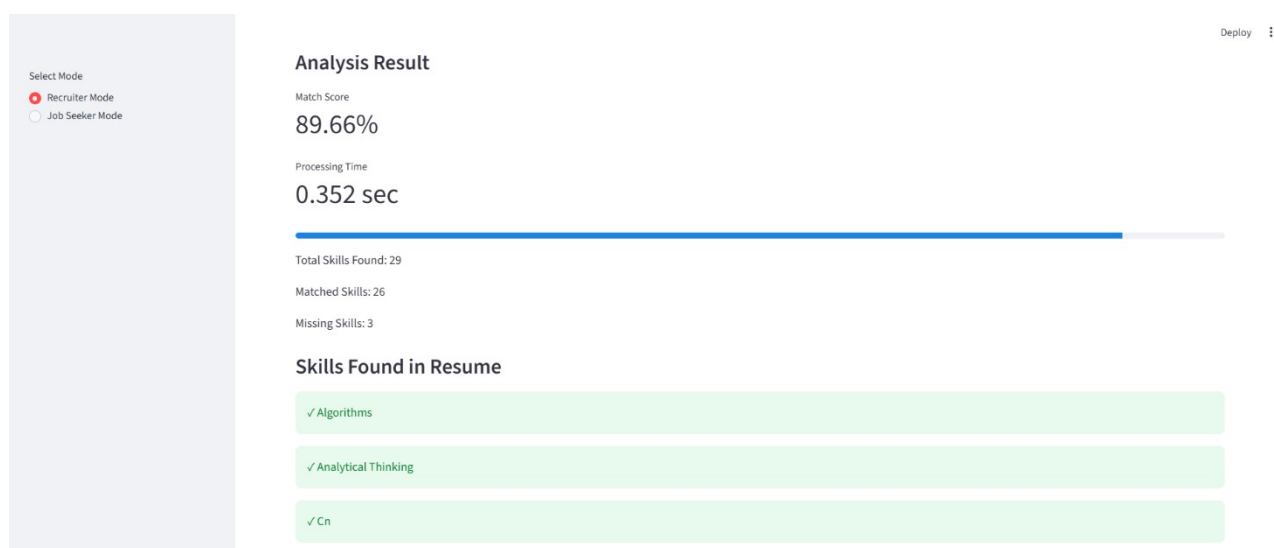


Figure 5. Resume Screening Output

## 7.3 Matching Score Generation

The system calculated a resume-job matching score based on the percentage of required job skills present in the uploaded resume. The generated score provides a quantitative measure of candidate-job compatibility and assists recruiters in prioritizing candidate evaluation. In addition, the system highlights missing skills, allowing candidates to identify areas for improvement.

## 7.4 Candidate Evaluation

Based on the calculated matching score, the system classified candidates into four predefined suitability categories:

- Highly Suitable Candidate
- Suitable Candidate
- Moderately Suitable Candidate
- Not Suitable Candidate

This automated classification simplifies the resume screening process and supports recruiters in making faster and more informed preliminary hiring decisions.

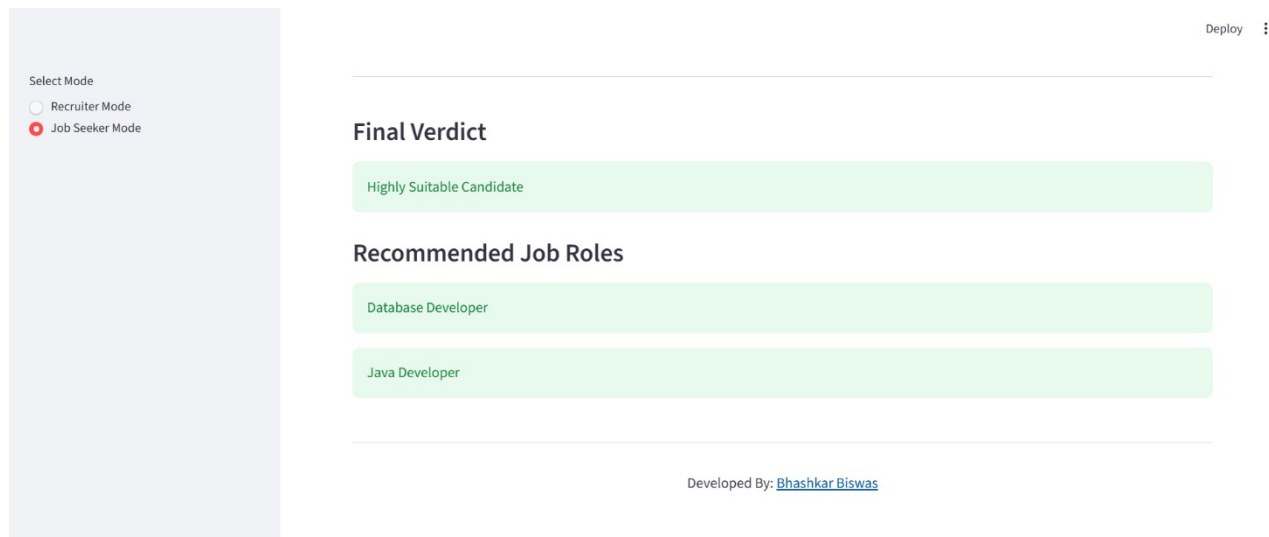


Figure 6. Job Recommendation Interface

### 7.5 Job Recommendation Functionality

The Job Seeker Mode successfully recommended suitable job roles based on the technical skills extracted from uploaded resumes. This functionality extends practical usefulness of the system beyond recruiter-focused screening by assisting candidates in relevant career opportunities that align with their skill sets.

### 7.6 Performance Evaluation

To evaluate the effectiveness of the developed system, experimental testing was conducted using manually labeled resume samples. Standard performance metrics were computed using the Scikit-learn library based on the generated evaluation dataset. The obtained results are presented in Table 1.

| Evaluation Metric       | Result    |
|-------------------------|-----------|
| Accuracy                | 90.00%    |
| Precision               | 92.00%    |
| Recall                  | 90.00%    |
| F1-score                | 88.89%    |
| Average Processing Time | 0.924 sec |

Table 1. Performance Evaluation of the Proposed System

The obtained results indicate that the proposed system achieved high candidate classification performance while maintaining an average resume processing time of less than one second. The evaluation demonstrates that the developed system is capable of efficiently performing resume screening and candidate evaluation, making it suitable for practical recruitment support applications.

## 7.7 Advantages and Current Limitations

The proposed system offers several practical advantages:

- Reduces manual resume screening effort.
- Automates technical skill extraction using NLP.
- Identifies matched and missing skills efficiently.
- Provides candidate suitability assessment.
- Recommends relevant job roles for job seekers.
- Offers a simple and user-friendly web-based interface.

Despite its effectiveness, the current implementation has certain limitations:

- Performance depends on the quality and formatting of uploaded PDF resumes.
- Skill extraction is limited to the predefined technical skills dataset used by the system.
- The current implementation primarily supports resumes written in English.
- Semantic understanding remains limited compared to advanced transformer-based language models and modern AI-based recruitment systems [24], [28].
- Fairness and bias evaluation mechanisms are not currently incorporated into the system [21], [35].

These limitations present opportunities for future enhancements and continued development.

Figures 4–6 demonstrate the major functionalities of the developed system. **Figure 4** presents the homepage interface with mode selection, **Figure 5** illustrates the resume screening output including resume-job matching score, matched and missing skills, and candidate suitability assessment, while **Figure 6** demonstrates the job recommendation interface available in Job Seeker Mode. Together with the experimental evaluation results presented in Table 1, these outputs validate the successful implementation and practical effectiveness of the proposed system.

## 8. Future Enhancement

Although the proposed Automated Resume Screening System demonstrates effective resume analysis, candidate evaluation, and job recommendation capabilities, several enhancements can further improve its functionality and practical applicability.

Future work may incorporate advanced transformer-based Natural Language Processing models such as BERT, RoBERTa, or Sentence Transformers to perform semantic skill matching and improve the understanding of contextual relationships between resumes and job descriptions. Such models can enhance candidate-job compatibility analysis beyond traditional keyword-based approaches.

The system can also be extended to support Applicant Tracking System (ATS) compatibility analysis, enabling candidates to assess the ATS friendliness and receive suggestions for improving resume quality.

Another potential enhancement is the integration of Generative AI techniques to provide personalized resume improvement suggestions, career guidance, and interview preparation recommendations based on candidate profiles.

Future versions may also integrate online job portals and recruitment platforms to provide real-time job recommendations and automated job matching. Additionally, multilingual resume processing can be

incorporated to support resumes written in different languages, thereby expanding the applicability of the proposed system.

From the recruiter perspective, future work may include candidate ranking, recruiter dashboards, authentication mechanisms, database integration, and analytical reporting features for large-scale recruitment management.

Finally, fairness, explainability, and bias-aware AI techniques can be incorporated to improve transparency, reliability, and ethical decision-making within intelligent recruitment systems.

## 9. Conclusion

The increasing volume of online job applications has created a growing need for efficient and intelligent recruitment solutions. Manual resume screening is often time-consuming, resource-intensive, and prone to inconsistencies, making it difficult for recruiters to efficiently evaluate large numbers of applicants.

This paper presented an Automated Resume Screening System developed using Natural Language Processing (NLP) techniques to automate resume analysis, technical skill extraction, candidate evaluation, and job recommendation. The proposed system utilizes NLP preprocessing techniques, including tokenization, lemmatization, stop-word removal, and text normalization, to extract relevant technical skills from PDF resumes and compare them with job description requirements. Based on this analysis, the system identifies matched and missing skills, calculates resume-job matching scores, classifies candidate suitability, and recommends appropriate job roles.

The developed system was successfully implemented as an interactive web-based application using Python, SpaCy, PDFPlumber, and Streamlit. Experimental evaluation demonstrated encouraging performance, achieving high classification accuracy while maintaining an average resume processing time of less than one second. These results indicate that the proposed system can effectively support intelligent recruitment by reducing manual effort, improving candidate evaluation, and assisting job seekers in identifying suitable career opportunities.

Overall, the proposed system demonstrates the practical application of Natural Language Processing in modern recruitment automation and provides a scalable foundation for future intelligent recruitment systems.

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