AI-Powered Resume Screening and Ranking System

A Project Report

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by

D ABHISHEK YADAV,

Email: d.abhishekyadav2004@gmail.com

Under the Guidance of

Mr. Saomya

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ABSTRACT

Recruitment is a fundamental process for any organization, ensuring that the best talent is selected to meet business objectives. However, manually screening a large volume of resumes is both time-consuming and inefficient, often leading to delayed hiring decisions and potential biases in candidate selection.

This project, **"AI-Powered Resume Screening and Ranking System**," leverages Natural Language Processing (NLP) and Machine Learning (ML) to automate and enhance the resume evaluation process. It utilizes TF-IDF (Term Frequency-Inverse Document Frequency) vectorization and cosine similarity to quantitatively assess and rank resumes based on their relevance to a given job description.

The system operates by extracting textual data from uploaded PDF resumes using PyPDF2, transforming the extracted text into a numerical representation, and calculating similarity scores against the job description. A higher similarity score indicates a better match, allowing recruiters to prioritize the most relevant candidates efficiently.

To make the system user-friendly, it is implemented with Streamlit, a Python-based framework that enables an interactive web-based interface. This ensures an accessible, intuitive, and real-time experience for HR professionals and recruiters.

By automating the initial screening process, this project aims to streamline recruitment workflows, reduce human effort, enhance hiring accuracy, and minimize biases, ultimately leading to a more effective and fair hiring process..

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CHAPTER 1

Introduction

1.1 Problem Statement:

The hiring process often involves sifting through a large number of resumes to find suitable candidates, which is both labor-intensive and prone to bias. Automating this process using AI can significantly improve efficiency and fairness.

1.2 Motivation:

With the growing number of job applications, recruiters struggle to manually evaluate resumes efficiently. This project aims to bridge this gap using AI-driven automation, making recruitment faster and more reliable.

1.3 Objective:

- Develop an AI-based system for resume screening.

- Rank candidates based on job relevance.

- Reduce hiring time and human bias in recruitment.

1.4 Scope of the Project:

- The system only processes PDF resumes.

- It evaluates resumes based on text similarity to job descriptions.

- Not designed to assess subjective factors like soft skills.

CHAPTER 2

Literature Survey

2.1 Review relevant literature or previous work in this domain.

The use of Artificial Intelligence (AI) in recruitment has been an area of increasing research and application. Previous studies have explored various techniques to automate resume screening and ranking. Traditionally, **keyword-based matching** has been the predominant approach used in Applicant Tracking Systems (ATS). However, this approach often lacks contextual understanding and may overlook well-qualified candidates due to rigid keyword dependency.

More advanced AI-based methods have been introduced, leveraging **Natural Language Processing (NLP)** and **Machine Learning (ML)** to improve resume screening efficiency. Research by Ming-Hsuan Yang et al. (2002) highlighted the importance of pattern recognition and machine learning in automating data extraction and classification tasks. Similarly, the work of Salton and Buckley (1988) introduced **TF-IDF (Term Frequency-Inverse Document Frequency)**, a widely used text-processing technique that enhances document ranking by assigning weight to relevant terms.

Recent studies also emphasize the role of **Deep Learning and Transformer-based models** like BERT in understanding resume content at a more granular level. These models have demonstrated significant improvements in candidate ranking by capturing the semantic meaning of job descriptions and resumes.

2.2 Mention any existing models, techniques, or methodologies related to the problem.

The following methodologies have been widely employed in AI-based resume screening systems:

- TF-IDF Vectorization: Converts textual data into numerical vectors based on term frequency, helping in text similarity calculations.

- Cosine Similarity: Measures the similarity between the job description and resumes, ensuring an effective ranking of candidates.

- Machine Learning Models (SVM, Decision Trees, Naïve Bayes, etc.): Used for predictive analysis in recruitment.

- Deep Learning Models (BERT, GPT-based models): Enhance contextual understanding and classification of resumes.

- Rule-Based Filtering: Commonly used in traditional ATS but often lacks flexibility and adaptability to nuanced resumes.

2.3 Highlight the gaps or limitations in existing solutions and how your project will address them.

Despite advancements in AI for recruitment, existing solutions have the following limitations:

- Lack of Contextual Understanding: Keyword-based models fail to interpret the meaning behind words, leading to incorrect candidate exclusions.
- Limited Adaptability: Most existing systems struggle with various resume formats (PDF, DOCX, TXT, etc.), reducing efficiency.
- Bias in AI Models: Many models inherit biases from training datasets, leading to unintended discrimination.
- Scalability Issues: Some AI models require extensive computational resources, limiting their practical implementation for small and medium-sized enterprises (SMEs).

How This Project Addresses These Gaps

Our AI-powered Resume Screening and Ranking System aims to bridge these gaps through:

- **Improved Accuracy Using TF-IDF and Cosine Similarity**: Ensuring better ranking of resumes based on contextual relevance rather than mere keyword matching.
- **Scalability with Lightweight NLP Models**: Utilizing an efficient approach that does not require extensive computational resources.
- **Bias Reduction**: Providing an objective ranking based purely on skills and qualifications extracted from resumes.
- **User-Friendly Interface with Streamlit**: Enabling HR professionals to easily upload resumes and obtain ranked results without technical expertise.

CHAPTER 3
Proposed Methodology

3.1   System Design

The system follows these steps:

1. **Extract text from uploaded PDF resumes** using **PyPDF2**.
2. **Convert text into numerical features** using **TF-IDF vectorization**.
3. **Compute cosine similarity** between resumes and job descriptions.
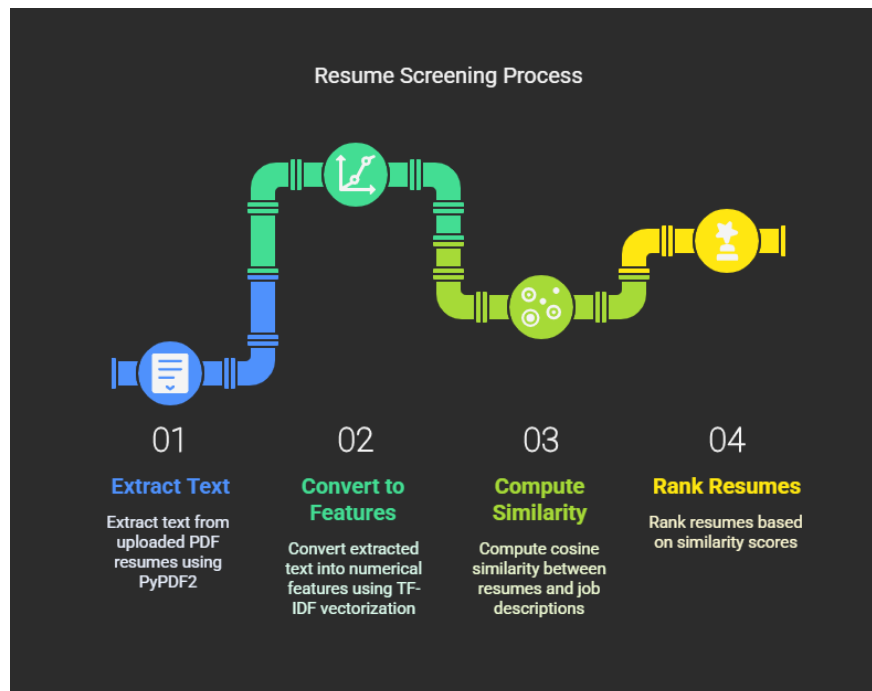4. **Rank resumes based on similarity scores**.

Figure-1: Resume screening process flowchart

3.2   Requirement Specification

Hardware: Standard PC/Laptop

Software: Python, Streamlit, PyPDF2, Scikit-learn

CHAPTER 4

Implementation and Result

4.1 Snap Shots of Result:

Figure -2 :code

Figure-3: Result before uploading resume

Figure-4: Result after uploading resume

Figure-5: Ranking resume

4.2 GitHub Link for Code:

https://github.com/codewithshek/AI-powered-Resume-Screening-and-Ranking-System

CHAPTER 5

Discussion and Conclusion

5.1   Future Work:

- Enhancing the model with advanced NLP techniques like BERT.

- Expanding support for more file formats (DOCX, TXT, etc.).

- Integrating with HR management systems.

5.2   Conclusion:

This project successfully demonstrates how AI can automate resume screening and ranking, significantly improving recruitment efficiency. By leveraging advanced Natural Language Processing (NLP) and Machine Learning (ML) techniques, the system effectively analyzes resumes against job descriptions to ensure precise candidate ranking.

Through the integration of TF-IDF vectorization and cosine similarity, this project enhances the accuracy of candidate evaluation, making the hiring process more reliable. Furthermore, automating the initial screening phase significantly reduces the time and effort required by HR professionals, allowing them to focus on more strategic aspects of recruitment.

Additionally, this system helps in mitigating human biases in hiring decisions, as it evaluates resumes based on objective textual similarity rather than subjective judgment. This ensures a fair and transparent recruitment process, aligning with modern HR standards.

By offering a user-friendly Streamlit interface, the project makes AI-driven resume screening accessible to recruiters with minimal technical expertise. This work serves as a foundation for future advancements in AI-powered recruitment tools, paving the way for the integration of deep learning models and enhanced contextual understanding mechanisms to further refine candidate selection processes.

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