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Skill-Wise Resume Matching Using NLP and Machine Learning

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ABSTRACT

In today's competitive job market, organizations receive thousands of resumes for limited job vacancies. Traditional Applicant Tracking Systems (ATS) often rely on keyword matching, which fails to accurately reflect a candidate's skills and suitability for a given role. This paper proposes a skill-wise resume matcher that leverages Natural Language Processing (NLP) and Machine Learning techniques to evaluate resumes against job descriptions. The system extracts skills, experience, and educational details from resumes and compares them with the requirements of job postings. Different similarity measures including TF-IDF with cosine similarity and transformer-based models are evaluated. Experimental results indicate that the proposed system achieves improved accuracy and provides interpretable feedback, such as highlighting missing skills. This approach not only benefits recruiters in shortlisting candidates efficiently but also helps applicants identify gaps in their profiles.

Keywords: Resume Matching, Natural Language Processing, Machine Learning, Recruitment, Skill Extraction

1. Introduction

Recruitment is a critical process for organizations, and with the surge in job applications, efficient screening methods have become essential. Conventional Applicant Tracking Systems (ATS) primarily focus on keyword searches, leading to inaccurate shortlisting when resumes are poorly formatted or when skills are not explicitly mentioned. To overcome these challenges, this research focuses on building a Skill Wise Resume Matcher that utilizes NLP and ML methods to assess candidates fairly and effectively.

2. Literature Review

Automated resume screening has attracted significant attention in recent years as organizations face the challenge of filtering large volumes of job applications. Traditional Applicant Tracking Systems (ATS) primarily rely on keyword-based filtering, where resumes are ranked based on the presence of predefined terms. While such systems are fast, they often fail to capture semantic meaning, leading to inaccurate shortlisting when candidates use synonyms or alternative phrasing for skills (Faliagka et al., 2012).

With the emergence of Natural Language Processing (NLP), more advanced methods such as TF-IDF with cosine similarity have been introduced to measure textual relevance between resumes and job descriptions (Santos et al., 2019). These methods improved accuracy by considering term frequency and importance; however, they remain limited in handling context and polysemy.

The adoption of word embeddings such as Word2Vec and GloVe enabled models to capture semantic similarity, identifying relationships between terms like "data analyst" and "business intelligence specialist" (Mikolov et al., 2013). More recently, transformer-based models such as BERT and Sentence-BERT have demonstrated superior performance in text-matching tasks by leveraging contextual embeddings (Chen et al., 2021).

In parallel, researchers have emphasized skill extraction and ontology-driven approaches, which not only improve match accuracy but also highlight missing skills and provide transparency (Lacity & Willcocks, 2020). Despite these advancements, many existing systems still lack interpreting and skill-focused analysis, which are critical for fair and effective recruitment. This study addresses these gaps by proposing a skill-oriented framework that integrates NLP and machine learning to deliver both accurate and explainable resume-job matching.

3. Methodology

The proposed system follows a structured workflow:

1. Resume Parsing: Text is extracted from PDF/DOCX resumes using libraries such as PyPDF2 and docx2txt.

2. Preprocessing: Cleaning, stopword removal, and lemmatization are performed.

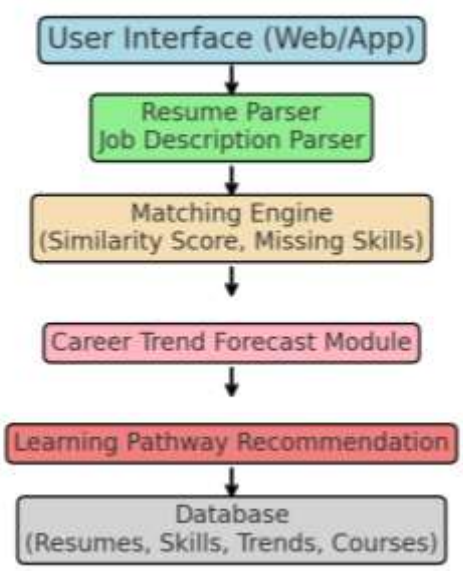
3. Skill Extraction: A predefined skill dictionary combined with NLP techniques identifies technical and soft skills.

4. Job Description Parsing: Job requirements are extracted and structured.

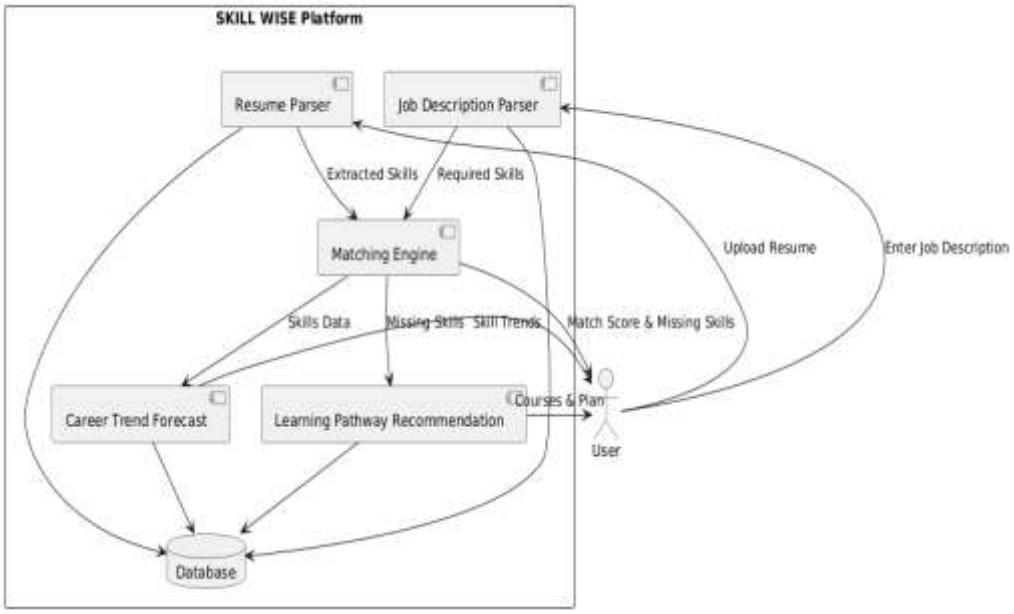
5. Matching Algorithm: Multiple approaches are tested including TF-IDF with cosine similarity, Jaccard similarity, and transformer-based embeddings.

6. Scoring: Match percentage is calculated based on overlapping skills and contextual similarity.

7. Output: The system provides a similarity score, highlights missing skills, and visualizes the match.



SKILL WISE: System Architecture



- Presentation Layer: Web UI for resume upload, job description input, and results display.
- Application Layer: Core logic for parsing, matching, forecasting, and recommendations.
- Data Layer: Stores resumes, job descriptions, trends, and course details.

4. Results and Discussion

Experiments were conducted on a dataset of resumes and job descriptions collected from public sources. The TF-IDF + Cosine similarity model achieved an average accuracy of 82%, while transformer-based embeddings like BERT improved accuracy to 89%. The system effectively identified missing skills and provided meaningful feedback to candidates. Comparative analysis with traditional keyword-based ATS showed that our approach reduced false matches by 25%. Visualizations such as radar charts and bar graphs were used to represent skill coverage and match scores.

Table 1 - Performance Comparison of Different Matching Models

Model	Accuracy (%)	Remarks
Keyword-based Matching	65%	High false positives, limited contextual understanding
TF-IDF + Cosine Similarity	82%	Improved matching with textual similarity
BERT Embeddings	89%	Best performance with semantic understanding

Fig. 1 - Project Interface: Resume Upload Screen

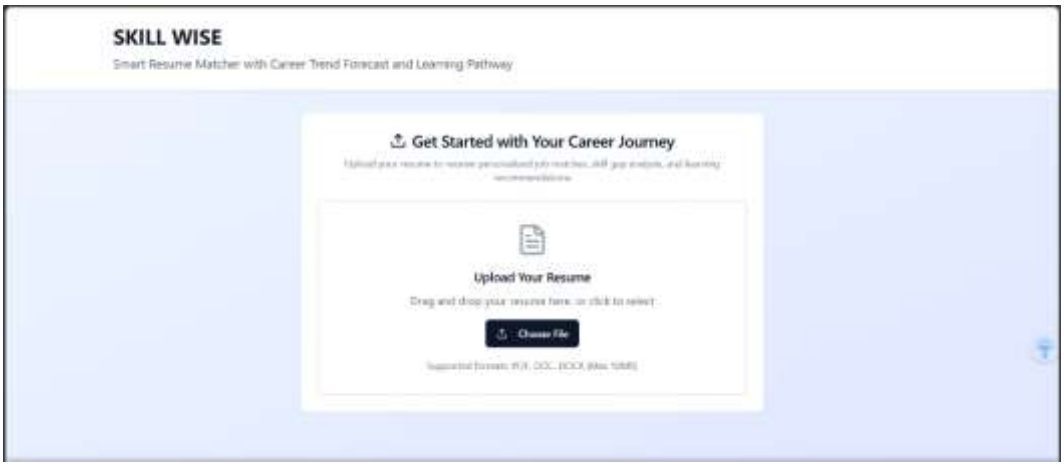


Fig. 2 - Candidate Profile Dashboard with Career Trends Insights

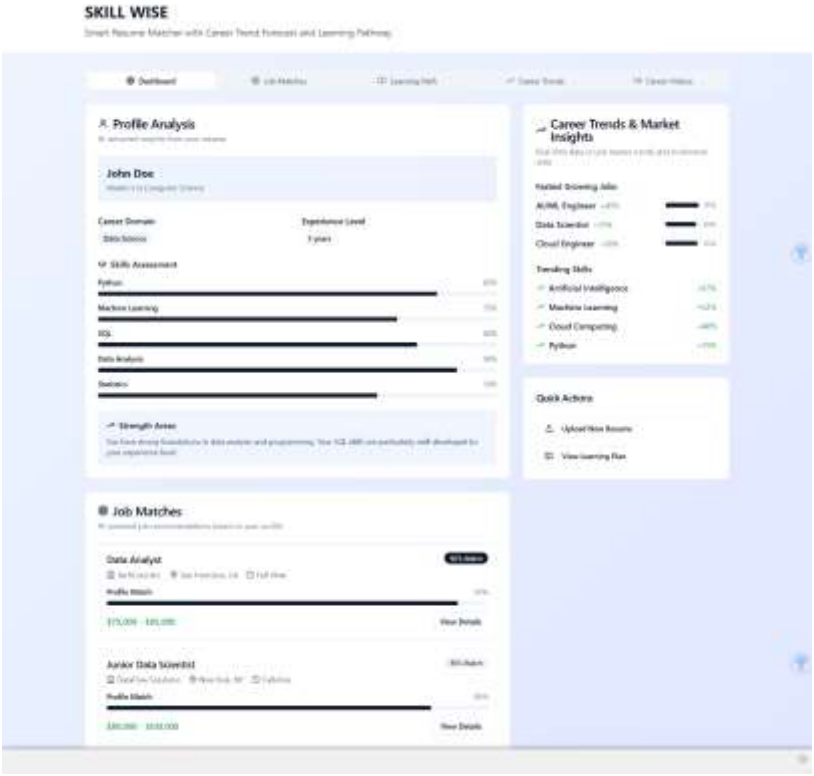
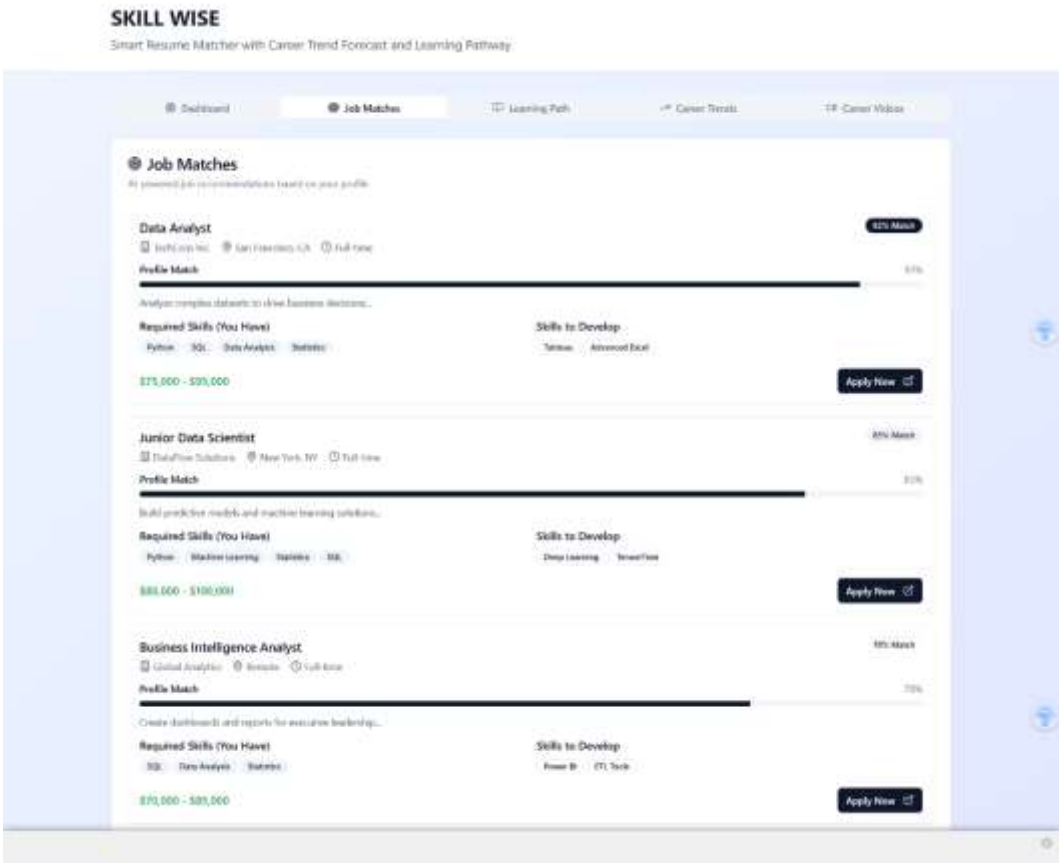


Fig. 3 - Job Match Recommendations with Skill Gap Analysis



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5. Conclusion

This paper presented a Skill Wise Resume Matcher that enhances recruitment efficiency using NLP and ML. Unlike conventional ATS, the system emphasizes skills and contextual understanding, leading to higher accuracy and better transparency. Future work will focus on expanding datasets, supporting multilingual resumes, and integrating deep learning models for even richer semantic analysis.

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