

Resume Analysis Using ML for Personalized Job Recommendations

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ABSTRACT

This project is titled “Resume Analysis Using ML Personalized Job Recommendation”. The system is develop using HTML, CSS, JS for the frontend with a Python backend powered by the Flask framework.

This project proposes an AI and Machine Learning–based Job Recommendation System to assist job seekers in identifying suitable job roles based on their profiles. In the modern job market, traditional career guidance methods such as manual resume screening are time-consuming and often inconsistent. The proposed system automates the resume analysis process to improve efficiency and accuracy. Candidate resumes submitted in PDF or DOCX formats are processed using Natural Language Processing techniques. Important details such as skills, educational qualifications, experience, certifications, and project work are extracted from the resume text. The extracted data is cleaned and preprocessed for further analysis. TF-IDF vectorization is used to convert textual information into numerical feature representations. Cosine Similarity is applied to compare candidate profiles with predefined job descriptions. Based on similarity scores, the system ranks and recommends the most suitable job roles. To enhance prediction accuracy, a supervised machine learning algorithm such as Random Forest is employed. The model is trained using historical resume and job placement data. It learns relationships between candidate attributes and successful job outcomes. This improves the reliability of recommendations. The system supports both freshers and experienced professionals. It provides unbiased and data-driven job suggestions. Additional features like skill gap analysis and career guidance can be integrated. The system can be deployed in recruitment platforms and campus placement systems. Overall, it offers an intelligent, scalable, and personalized job recommendation solution.

1. INTRODUCTION

The rapid growth of digital technologies has significantly transformed the recruitment and job search process in recent years. Traditional methods of resume screening and job matching often involve manual effort, which is time-consuming, error-prone, and lacks consistency. Recruiters are required to review hundreds or even thousands of resumes, making it difficult to identify the most suitable candidates efficiently. At the same time, job seekers struggle to find roles that match their skills, qualifications, and career goals. This gap between job requirements and candidate capabilities highlights the need for an intelligent and automated system that can streamline the recruitment process and improve decision-making accuracy.

With the advancement of Artificial Intelligence and Machine Learning, automated systems have become capable of analyzing large volumes of data and extracting meaningful insights. In the context of recruitment, these technologies can be used to process resumes, understand candidate profiles, and match them with relevant job opportunities. Natural Language Processing (NLP) plays a crucial role in interpreting unstructured resume data by extracting key information such as skills, education, experience, and certifications. By converting textual data into structured formats, machine learning models can efficiently analyze and compare candidate profiles with job descriptions, enabling more accurate and faster job recommendations.

The proposed Resume Analysis Using ML For Personalized Job Recommendations aims to address these challenges by providing an intelligent platform for resume analysis and job recommendation. The system uses advanced techniques such as TF-IDF vectorization and cosine similarity to measure the relevance between candidate profiles and job roles. Additionally, a supervised machine learning algorithm like Random Forest is employed to enhance prediction accuracy by learning from historical data. This approach ensures that the recommendations are not only based on keyword matching but also on deeper patterns and relationships between candidate attributes and successful job placements.

Furthermore, the system is designed to benefit both job seekers and recruiters by providing a scalable, efficient, and unbiased solution. It supports candidates from various backgrounds, including fresh graduates and experienced professionals, by offering personalized job suggestions and identifying skill gaps. The integration of automated notifications ensures that candidates are informed about relevant opportunities in a timely manner. This system can be widely applied in recruitment platforms, job portals, and campus placement systems, ultimately improving the overall hiring process. By leveraging AI-driven insights, the proposed solution contributes to a smarter and more effective recruitment ecosystem.

2. LITERATURE REVIEW

P. K. Roy, S, and R. Bhatia 2020 focused on automating resume recommendation systems using Machine Learning techniques. The study emphasized the challenges faced by recruiters due to the large volume of resumes and proposed a content-based filtering approach. The authors utilized classification algorithms and similarity measures such as cosine similarity to match resumes with job descriptions. Their system demonstrated how Natural Language Processing could extract meaningful features from unstructured resume data. Additionally, the work highlighted the importance of ranking candidates based on relevance scores. The study concluded that automated systems significantly reduce time and effort in recruitment processes. It also improved decision-making accuracy compared to manual screening. The research laid a strong foundation for modern AI-based recruitment systems. Overall, this work contributed to the early development of intelligent resume screening solutions.

S. Chowdhary 2020 research on automated resume screening systems focused on improving recruitment efficiency using Machine Learning techniques. The studies emphasized the challenges of handling large volumes of resumes and proposed solutions based on content-based filtering methods. Natural Language Processing techniques were used to extract meaningful information such as skills, education, and experience from unstructured resume data. Similarity measures like cosine similarity were widely used to match candidate profiles with job descriptions. These systems aimed to reduce manual effort and increase accuracy in candidate selection. The results showed that automated systems could significantly improve the speed of recruitment processes. Additionally, ranking mechanisms were introduced to prioritize suitable candidates. The research highlighted the importance of data preprocessing for better performance. Overall, this year laid the foundation for AI-based recruitment systems.

Corné de Ruijt and Sandjai Bhulai 2021 conducted a comprehensive review of job recommender systems. Their work analyzed various machine learning models used for job matching and highlighted the importance of hybrid recommendation techniques. The study discussed how combining collaborative and content-based filtering improves recommendation accuracy. It also emphasized fairness and bias issues in recruitment systems, which are often overlooked. The authors pointed out that data quality and availability significantly impact system performance. Furthermore, they explored the role of user behavior and temporal data in improving recommendations. The research suggested that intelligent systems should consider both candidate preferences and job requirements. This study provided valuable insights into designing efficient job recommendation systems. It also encouraged the development of unbiased and transparent AI models.

Corné de Ruijt 2021 advancements in job recommendation systems focused on improving accuracy through hybrid approaches. Research explored the combination of collaborative filtering and content-based filtering techniques. These methods enhanced recommendation quality by considering both candidate profiles and job requirements. Studies also addressed issues such as bias and fairness in recruitment systems. The importance of high-quality datasets and feature engineering was emphasized. Additionally, systems began incorporating user preferences and behavior into recommendations. This led to more personalized job suggestions for candidates. Researchers also explored evaluation

metrics to measure system performance effectively. The findings highlighted the need for transparent and unbiased AI systems. This year contributed to improving the reliability of job recommendation models.

Lokesh S, Mano Balaje S, Prathish E, and B. Bharathi 2022 focused on resume screening and recommendation using machine learning approaches. The authors highlighted the complexity of handling unstructured resume data and proposed the use of NLP techniques for information extraction. Their system extracted key attributes such as skills, education, and experience from resumes. Machine learning models were trained to classify candidates based on job suitability. The study also introduced a recommendation mechanism for suggesting alternative job roles. It emphasized reducing recruiter workload and improving efficiency. The results showed improved accuracy in matching candidates with appropriate roles. The research demonstrated the effectiveness of combining NLP with machine learning. It contributed significantly to practical implementations of resume analysis systems.

D. L. Padmaja, Ch. Vishnuvardhan, G. Rajeev, and K. N. S. Kumar 2023 worked on automated resume screening using NLP techniques. Their study focused on extracting structured information from resumes and comparing it with job descriptions. The system utilized text processing methods such as tokenization and entity recognition. It also applied machine learning algorithms for classification and ranking of candidates. The authors emphasized improving hiring efficiency and reducing human bias. Their approach demonstrated better performance in handling large datasets. Additionally, the system provided accurate matching between candidate profiles and job roles. The research highlighted the growing importance of AI in recruitment. It also suggested future improvements using deep learning techniques.

Ch. Vishnuvardhan 2023 Research focused on integrating Natural Language Processing with Machine Learning for resume analysis. Systems were developed to extract key attributes such as skills, education, certifications, and experience. These features were then used to classify and recommend suitable job roles. Machine learning algorithms improved the accuracy of candidate-job matching. Studies also emphasized reducing recruiter workload by automating repetitive tasks. The use of structured data representations improved system efficiency. Additionally, recommendation systems were designed to suggest alternative career paths. Results showed significant improvements in prediction accuracy. Researchers highlighted the importance of scalability in handling large datasets. This year marked progress in practical implementations of automated recruitment systems.

Dr. Sandeep Tayal, Taniya Sharma, Shivansh Singhal, and Anurag Thakur 2024 explored resume screening using machine learning and NLP techniques. The study proposed the use of algorithms such as K-Nearest Neighbors and Support Vector Machines for classification tasks. It focused on improving the accuracy and speed of candidate selection. The system used techniques like part-of-speech tagging and named entity recognition for feature extraction. The authors highlighted the limitations of traditional manual screening methods. Their results showed significant improvements in efficiency and consistency. The research also emphasized the scalability of automated systems. It provided a robust framework for intelligent recruitment solutions. This work further strengthened AI-based hiring systems.

Rui Ern Yap, Su Cheng Haw, and Shaymaa Al-Juboori 2024 presented a comprehensive review of machine learning-based job recommendation systems. The study highlighted the increasing demand for intelligent systems due to the dynamic job market. It discussed various machine learning models used for predicting suitable job roles. The authors emphasized the importance of evaluation metrics in measuring system performance. The research also explored hybrid recommendation techniques for improved accuracy. Additionally, it addressed challenges such as scalability and data sparsity. The study suggested integrating advanced AI models for better predictions. It concluded that machine learning plays a vital role in modern recruitment systems. This research contributed to enhancing job recommendation technologies.

Vernika Khatri, Vikas Kumar, Kapil Thakur 2025 Yadav proposed an AI-powered resume screening and job matching system. The research focused on reducing recruiter workload and improving hiring efficiency. The system used NLP techniques to extract relevant information from resumes. Machine learning models were applied for classification and recommendation tasks. The authors highlighted the importance of real-world datasets for system evaluation. Their results showed high accuracy in matching candidates with job roles. The study also emphasized fairness and transparency in recruitment. It demonstrated the practical application of AI in hiring processes. This work contributed to scalable and intelligent recruitment solutions.

Dr. A. Karunamurthy and R. Sujitha 2025 introduced an AI-driven resume screening and job recommendation system using advanced models like BERT. The study focused on improving accuracy through deep learning techniques. It combined resume screening with predictive analytics for better job matching. The system extracted detailed features from resumes using NLP. It also applied similarity measures and classification models for recommendations. The authors highlighted the efficiency of automated systems in handling large datasets. Their approach demonstrated improved performance compared to traditional methods. The research emphasized the future scope of AI in recruitment. It provided insights into next-generation intelligent hiring systems.

3. PROJECT OVERVIEW

The Resume Analysis Using ML For Personalized Job Recommendations is an intelligent web-based application designed to simplify and enhance the recruitment process using Artificial Intelligence and Machine Learning techniques. The system is developed using HTML, CSS, and JavaScript for the frontend, while Python with the Flask framework is used for backend processing. It allows users to upload their resumes in formats such as PDF and DOCX, which are then automatically analyzed using Natural Language Processing techniques. The system extracts key information including skills, educational qualifications, work experience, certifications, and projects. This extracted data is cleaned and preprocessed to ensure accuracy and consistency before further analysis. By automating these tasks, the system significantly reduces manual effort and improves the efficiency of resume screening.

The core functionality of the system lies in matching candidate profiles with suitable job roles using advanced algorithms. Textual data from resumes and job descriptions is converted into numerical form using TF-IDF vectorization, and cosine similarity is applied to measure the relevance between them. Based on similarity scores, the system ranks and recommends the most appropriate job opportunities for each candidate. Additionally, a supervised machine learning model such as Random Forest is used to enhance prediction accuracy by learning from historical data. The system also includes features like automated notifications, personalized job suggestions, and potential skill gap identification. Overall, the project provides a scalable, reliable, and user-friendly solution that benefits both job seekers and recruiters by making the hiring process faster, smarter, and more effective.

3.1 MODULE DESCRIPTION

Data Collection – Gathers resumes, job descriptions, and historical placement data from portals or datasets to fuel training and testing.

Data Preprocessing – Cleans raw data by removing noise, duplicates, and missing values, then normalizes text for consistent quality.

Resume Upload – Accepts PDF/DOCX resumes from users, validates file type and size, and securely stores submissions.

Resume Parsing & Text Extraction – Converts uploaded PDF/DOCX files into machine-readable text, handling varied layouts for accurate extraction.

NLP-Based Feature Extraction – Uses NLP to identify skills, education, experience, and certifications via tokenization and keyword selection.

Feature Vectorization (TF-IDF) – Transforms text features into numerical vectors, enabling mathematical comparison between resumes and job descriptions.

Job Similarity Matching – Applies Cosine Similarity to score and rank job descriptions against candidate profiles for initial recommendations.

Machine Learning Prediction – Uses a Random Forest model trained on historical data to learn placement patterns and refine recommendations.

Job Recommendation – Combines similarity scores and ML predictions to generate a ranked, personalized list of compatible job roles for the user.

4. SYSTEM ARCHITECTURE

The system architecture consists of interconnected modules that work together to deliver accurate job recommendations to users and recruiters.

Web Interface The Web Interface serves as the entry point for both Users and Recruiters. Users submit their resumes while recruiters provide job-related inputs. It enables smooth interaction between end users and the backend system.

NLP & Machine Learning Model The core processing layer receives input from the Resume Dataset and the Web Interface. It incorporates three key components:

- **Natural Language Processing** – extracts meaningful information from resume text
- **TF-IDF Vectorization** – converts text into numerical feature vectors
- **Random Forest Model** – predicts job suitability based on learned patterns

Its output feeds directly into the Job Recommendation database.

Data Processing This layer handles the preparation of raw resume data through:

- **Resume Parsing** – extracts text from PDF/DOCX files
- **Data Preprocessing** – removes noise, duplicates, and inconsistencies
- **Feature Extraction** – identifies skills, experience, and qualifications

Analysis Module The processed features are analyzed using:

- **Cosine Similarity** – measures relevance between resumes and job descriptions
- **Candidate Ranking** – ranks candidates or jobs based on compatibility scores
- **Feature Extraction** – further refines key attributes for matching

Job Recommendation The final module consolidates results from the Analysis Module and ML Model to generate a ranked, personalized list of job recommendations displayed to the user.

5. PROBLEM STATEMENT

In the current recruitment process, organizations face significant challenges in efficiently handling and evaluating a large number of resumes submitted by job seekers. Traditional resume screening methods are mostly manual, requiring recruiters to spend considerable time reviewing each application individually. This process is not only time-consuming but also prone to human errors, inconsistencies, and biases. Recruiters may overlook qualified candidates due to fatigue or lack of standardized evaluation criteria. Additionally, resumes are usually submitted in unstructured formats such as PDF or DOCX, making it difficult to extract and analyze relevant information effectively. The absence of automated tools leads to inefficiencies in filtering, ranking, and shortlisting candidates. Moreover, job seekers often struggle to identify suitable job roles that match their skills and qualifications. This mismatch results in reduced hiring efficiency and increased dissatisfaction among both recruiters and candidates. Therefore, there is a strong need for an intelligent system that can automate and optimize the resume screening process.

Another major problem is the lack of personalized job recommendations and real-time communication between candidates and recruitment systems. Existing platforms often rely on keyword-based searches, which may not accurately reflect a candidate's true capabilities or potential. This leads to irrelevant job suggestions and missed opportunities for suitable candidates. Furthermore, many systems do not provide insights into skill gaps, leaving candidates unaware of areas they need to improve. The absence of data-driven decision-making reduces the effectiveness of the recruitment process. Additionally, recruiters lack tools that can learn from past hiring data to improve future predictions. The inability to process large datasets efficiently limits the scalability of traditional systems. There is also a need to ensure fairness and eliminate bias in candidate selection. Without automation and intelligent analysis, the recruitment process remains

slow, inefficient, and less reliable. Hence, developing a smart, AI-based resume scanning and job recommendation system becomes essential to address these challenges and improve overall hiring outcomes.

6. OBJECTIVES

The primary objective of the Resume Analysis Using ML For Personalized Job Recommendations is to automate the resume screening process and improve the efficiency of candidate selection. The system aims to reduce manual effort by using Artificial Intelligence and Machine Learning techniques to analyze and process resumes submitted in various formats such as PDF and DOCX. It focuses on extracting key information including skills, education, experience, and certifications using Natural Language Processing techniques. Another important objective is to convert unstructured textual data into meaningful numerical representations using methods like TF-IDF. This enables accurate comparison between candidate profiles and job descriptions. The system also aims to rank candidates based on relevance and provide suitable job recommendations using similarity measures such as cosine similarity. By doing so, it ensures faster and more consistent decision-making in recruitment processes.

The secondary objective of the project is to enhance the quality and accuracy of job recommendations through the use of supervised machine learning algorithms like Random Forest. The system is designed to learn from historical data and improve its prediction capability over time. It also aims to provide personalized suggestions for both freshers and experienced professionals based on their profiles. Additionally, the project focuses on identifying skill gaps and offering career guidance to help candidates improve their employability. Another objective is to implement an automated notification system that alerts users about relevant job opportunities in real time. The system is intended to be scalable, user-friendly, and applicable in various domains such as job portals, recruitment platforms, and campus placement systems. Overall, the goal is to create an intelligent, unbiased, and efficient solution for modern recruitment challenges.

7. PROPOSED SYSTEM

The proposed system, titled Resume Analysis Using ML For Personalized Job Recommendations, is designed to overcome the limitations of traditional recruitment methods by incorporating Artificial Intelligence and Machine Learning techniques. This system automates the process of resume screening by allowing candidates to upload their resumes in formats such as PDF and DOCX. Using Natural Language Processing, the system extracts important information such as skills, educational qualifications, work experience, certifications, and projects from unstructured data. The extracted information is then preprocessed and converted into structured data for further analysis. Techniques like TF-IDF are used to transform textual data into numerical vectors, enabling efficient comparison. Cosine similarity is applied to match candidate profiles with job descriptions and calculate relevance scores. Based on these scores, the system ranks candidates and recommends suitable job roles. Additionally, a supervised machine learning model such as Random Forest is used to improve prediction accuracy by learning from historical data. The system provides personalized job recommendations for both freshers and experienced professionals. It also includes features such as skill gap analysis to guide candidates in improving their profiles. Automated notification functionality ensures that users are informed about relevant job opportunities in real time. The system reduces manual effort, improves efficiency, and ensures unbiased decision-making. It is scalable and capable of handling large volumes of data effectively. Furthermore, the system can be integrated into job portals, recruitment platforms, and campus placement systems. Overall, the proposed system offers a smart, reliable, and efficient solution for modern recruitment challenges.

8. SYSTEM IMPLEMENTATION

System maintenance is a crucial phase in the lifecycle of the Resume Analysis Using ML For Personalized Job Recommendations, ensuring that the application continues to function efficiently after deployment. It involves regularly monitoring the system to detect and fix bugs, errors, and performance issues that may arise during real-time usage. As the system handles large volumes of resumes and job data, it is important to maintain database performance and optimize query execution. Updates are required to keep the Natural Language Processing and Machine Learning models accurate and relevant to changing job market trends. The system also needs periodic upgrades to improve functionality and add new features. Corrective maintenance is performed to fix any issues reported by users. Adaptive maintenance ensures that the system remains compatible with new technologies, software updates, and operating environments. Preventive

maintenance is carried out to reduce the chances of future failures. Proper backup mechanisms are implemented to prevent data loss. Regular testing is conducted after updates to ensure system stability. Security updates are essential to protect user data from potential threats. Documentation is maintained for tracking changes and improvements. Overall, system maintenance ensures long-term reliability, efficiency, and smooth operation of the application.

The system maintenance process also focuses on enhancing user experience and improving system performance over time. Continuous monitoring tools are used to track system behavior, detect anomalies, and ensure optimal performance. Feedback from users and recruiters is collected and analyzed to identify areas for improvement. Based on feedback, modifications and enhancements are implemented to meet user requirements. The machine learning model is retrained periodically using updated datasets to improve prediction accuracy and recommendation quality. Performance tuning techniques are applied to reduce response time and improve scalability. The system is also maintained to handle increasing numbers of users and data efficiently. Regular updates are made to the user interface to ensure it remains user-friendly and visually appealing. Compatibility with different browsers and devices is checked and maintained. Additionally, maintenance includes ensuring smooth integration with external systems such as job portals and notification services. Logging and auditing mechanisms are used to track system activities and detect issues early. All updates and changes are tested thoroughly before deployment. This continuous maintenance process ensures that the system remains effective, secure, and aligned with evolving technological advancements.

ACKNOWLEDGEMENT

We would like to express our sincere gratitude to all those who contributed to the successful completion of this project. We are especially thankful to our project guide, **Mrs. INDULEKHA K V , Assistant Professor, Department of Computer Applications**, for his valuable guidance, encouragement, continuous support, and constructive suggestions throughout the development of this project.

We also extend our heartfelt thanks to the faculty members of the **Department of Computer Applications, Nehru Institute of Information Technology and Management, Coimbatore**, for providing the necessary academic environment, technical support, and learning opportunities required for completing this work successfully.

Finally, we express our gratitude to our family members, friends, and well-wishers whose encouragement, motivation, and support helped us complete this project successfully.

9. CONCLUSION

The Resume Analysis Using ML For Personalized Job Recommendations presents an innovative and efficient approach to modern recruitment by leveraging Artificial Intelligence and Machine Learning techniques. In today's fast-paced job market, manual resume screening is no longer practical due to the large volume of applications and the need for quick decision-making. This system effectively automates the process of analyzing resumes, extracting key information, and matching candidate profiles with suitable job roles. By using Natural Language Processing, the system converts unstructured resume data into structured and meaningful information, enabling accurate analysis. Techniques such as TF-IDF vectorization and cosine similarity help in comparing resumes with job descriptions and determining relevance scores. The integration of a supervised machine learning algorithm like Random Forest further enhances the accuracy and reliability of job recommendations. The system not only assists recruiters in selecting the best candidates but also helps job seekers identify opportunities that match their skills and qualifications. Features such as personalized job recommendations and skill gap analysis provide added value to users by guiding them toward career improvement. Automated notification functionality ensures timely updates about job openings, improving user engagement. The system reduces human bias and ensures fair and consistent evaluation of candidates. It is scalable and capable of handling large datasets efficiently, making it suitable for real-world applications. The user-friendly interface enhances accessibility and usability for both recruiters and candidates. Moreover, the system can be integrated with job portals, recruitment platforms, and campus placement systems. Continuous updates and maintenance ensure that the system remains relevant to changing industry demands. Overall, the project demonstrates how intelligent technologies can transform traditional recruitment processes into efficient and data-driven systems. It improves hiring efficiency, reduces workload, and enhances the overall experience for users. Thus, the proposed system stands as a powerful, reliable, and future-ready solution for modern recruitment challenges.

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