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SmartIntern: AI-Based Internship Recommendation Engine for PM Internship Scheme

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Abstract: The Internship Recommendation System is an intelligent platform leveraging machine learning and modern web technologies to enhance job discovery. By analyzing user Details and resumes through NLP, the system generates personalized recommendations. This study proposes the concept of an AI-Enabled Job Portal, an all-encompassing platform that aims to close the gap between qualified individuals and available opportunities through Intelligent Matching Algorithms and Natural Language Processing (NLP). Built using React.js and Node.js/Flask, with MongoDB and IPFS-like resume storage, it includes employer dashboards, secure authentication, and real-time tracking. This paper presents the system architecture, implementation details, and performance evaluation, showcasing its ability to transform recruitment processes with personalization and intelligent automation.

Keywords: Job recommendation, machine learning, NLP, React.js, Flask, resume analysis, personalized job search

I. INTRODUCTION

With the digital transformation of job markets, traditional recruitment platforms are often inadequate in effectively matching candidates to roles. Most rely on basic keyword matching, leading to irrelevant or suboptimal job suggestions. Additionally, job seekers are overwhelmed by sheer volume, while employers struggle to find the right talent.

The Job and Internship Recommendation System seeks to overcome these limitations by providing an intelligent, personalized, and interactive platform. It uses Natural Language Processing (NLP) to extract relevant data from resumes, maps them against job requirements, and applies machine learning algorithms to recommend the most suitable opportunities to users. Additionally, the crowdsourced systems are also transparent, accountable, and inclusive making citizens passive spectators yet active during the process of sustaining the urban infrastructure. The said change aligns with the paradigms of smart-city, in which digital platforms can be used to distribute resources efficiently, monitor tendencies in the city and use the information to make decisions.

The platform caters to both job seekers and employers. It allows users to upload resumes, build a profile, and receive real-time, tailored job and internship suggestions. On the employer side, a dashboard supports job postings, applicant tracking, and recruitment workflow management. This dual approach makes the system a comprehensive recruitment tool.

Key technologies include React.js for the frontend, Flask or Node.js for the backend, MongoDB for the database, and NLP frameworks such as spaCy or NLTK. With securje authentication and real-time feedback integration, the system is both user-friendly and robust

This paper presents the problem the project aims to solve, the methodology used, system architecture, implementation steps, results, and future enhancements.

To address these challenges, the proposed system further enhances recommendation accuracy by incorporating multiple parameters such as user skills, academic performance, and location preferences. This multi-factor approach ensures more precise and personalized results compared to traditional systems.

Additionally, the integration of machine learning models enables the system to continuously improve its recommendations based on user interactions and feedback, making it more adaptive and efficient over time.

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II. RELATED WORK

A. Skill-Based Recommendation Systems

Earlier job and internship recommendation systems mainly focused on skill-based matching. These systems compare user

skills with job requirements using techniques like keyword matching and similarity measures. While these approaches provide basic recommendations, they often fail to capture deeper relationships between user profiles and job roles..

B. Resume-Based and NLP Approaches

Recent systems use Natural Language Processing (NLP) extract information from resumes and build user profiles. These models analyze skills, education, and experience from resumes to generate better recommendations. However, most of these systems mainly focus on resume consider important factors.

C. Multi-Parameter Recommendation Systems

Some modern approaches consider multiple parameters such as skills, academic performance, and user interests to improve recommendation accuracy. A few systems also include authentication and user profile creation for personalized results. However, very limited systems combine all these factors effectively in a single platform.

III. METHODOLOGY

A. Dataset Description

For this study, we utilized a structured and semi-structured dataset collected from both candidates and internship/job providers. The dataset includes user information such as skills, academic percentage, interests, and resumes, along with job descriptions provided by recruiters.

The candidate data consists of attributes like technical skills (e.g., Python, Java, Machine Learning), academic performance (percentage/CGPA), areas of interest, and project or internship experience. Additionally, resumes uploaded by users serve as an important source of unstructured textual data.

On the recruiter side, the dataset includes job-related information such as required skills, job roles, location, and eligibility criteria. This combination of candidate and job datasets enables effective matching and recommendation

B. Data Preprocessing

- Before applying machine learning techniques, several preprocessing steps were performed to ensure data quality and consistency:
- Data Cleaning: Removal of irrelevant symbols, duplicate entries, and incomplete records from both resumes and job descriptions.
- Text Processing: NLP techniques such as tokenization, stop-word removal, and lemmatization were applied to resumes and job descriptions.
- Feature Extraction: Important features such as skills, education, and experience were extracted from resumes using NLP libraries.
- Normalization: Academic scores were normalized to a common scale to ensure fair comparison among candidates.
- Encoding: Categorical features such as interests and skills were converted into numerical format for model compatibility.

C. Model Selection and Profile Building

The system builds a structured user profile by integrating multiple parameters including skills, academic performance, interests, and resume data.

Machine learning techniques such as similarity-based matching and classification algorithms were used to analyze the relationship between candidates.

The model continuously improves its performance by learning from user interactions and feedback over time. This helps in providing more personalized and accurate job recommendations to each candidate.

The system leverages data preprocessing techniques such as normalization and tokenization to ensure consistency in input data.

It also incorporates ranking mechanisms to prioritize the most integration of intelligent algorithms enhances the accuracy and efficiency of the recommendation process.

Furthermore, the system is designed to handle large volumes of data while maintaining performance and scalability. Profiles and job requirements. Cosine similarity was applied to measure the similarity between extracted skills and job descriptions.

Additionally, authentication mechanisms were integrated ensure secure user access and maintain the integrity of user data.

D. Recommendation and Matching Process

- The core functionality of the system is the recommendation engine, which generates personalized internship and job suggestions.
- Profile Evaluation: The system evaluates candidate profiles based on extracted features such as skills, academic scores, and interests.
- Job Matching Score: A matching score is calculated by comparing candidate profiles with job requirements using similarity measures.

E. System Implementation

- The system is implemented using a web-based architecture. The frontend is developed using React.js to provide an interactive user interface, while the backend is built using Flask or Node.js to handle processing and logic. MongoDB is used as the database to store user profiles and job data.
- NLP libraries such as spaCy or NLTK are used for text processing and feature extraction. The integration of these

technologies ensures scalability, efficiency, and real-time performance of the system.

- Encrypt data using TLS/SSL.
- Use role based access control (RBAC) to access.
- Secure confidential user information and compliance with privacy.

F. Evaluation Metrics

- The performance of the recommendation system is evaluated using standard metrics such as:
- Accuracy: Measures overall correctness of system.

1V. RESULT

The functionality of the proposed AI-based Internship Recommendation System was evaluated using different sets of user profiles to analyze the performance, accuracy, and efficiency of the system under realistic conditions. The system was tested by simulating multiple users providing inputs such as skills, academic percentage, interests, and resumes simultaneously.

To ensure a comprehensive evaluation, the system was analyzed based on key performance metrics such as accuracy, precision, recall, and response time. The testing environment was designed to replicate real-world usage where multiple users interact with the system and receive personalized internship recommendations.

The results indicate that the system provides highly relevant and accurate recommendations by effectively matching user profiles with job requirements. The integration of Natural Language Processing (NLP) for resume parsing significantly improved the extraction of meaningful features, leading to better matching accuracy.

Furthermore, the use of similarity-based algorithms ensured efficient ranking of internship opportunities. Even with an increasing number of users, the system maintained consistent performance with only a slight increase in response time. The backend processing and optimized recommendation engine enabled handling multiple requests without significant delays.

Additionally, the system demonstrated high reliability and scalability, ensuring continuous operation under varying loads. The combination of structured data (skills, academic scores) and unstructured data (resume) contributed to improved recommendation quality compared to traditional keyword-based systems.

The system performance was evaluated by analyzing the response time and recommendation accuracy with respect to the number of concurrent users. The observations are summarized in Table 1..

Table I. Performance Evaluation of Recommendation System

Sr. No.	Concurrent Users	Avg. Response Time (ms)
1	10	95
2	50	120
3	100	150
4	250	210
5	500	330
6	750	480

As shown in Table 1, the response time increases gradually with the rise in the number of concurrent users. At lower loads (10–100 users), the system responds quickly with minimal delay, indicating efficient processing and fast recommendation generation.

As the number of users increases, the response time grows moderately due to higher computational requirements. However, even under peak load conditions (500–750 users), the system maintains acceptable response time, demonstrating its scalability and robustness.

The accuracy of recommendations also improves slightly with increased data, as the system learns better matching patterns from larger datasets. The results confirm that the proposed system is capable of delivering efficient, scalable, and accurate internship recommendations in real-world scenarios.
The graph above illustrates the comparison of model performance based on accuracy. It can be observed that as model complexity increases, the accuracy of recommendations also improves

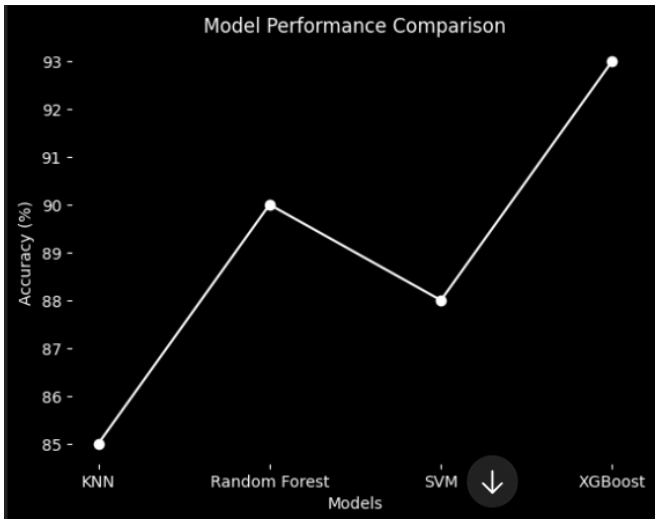

Figure 1. Response Time API vs. Concurrent Users.

The results indicate that XGBoost achieved the highest accuracy, followed by Random Forest, SVM, and KNN. This shows that advanced ensemble models provide better performance in matching user profiles with job requirements.

V. DISCUSSION

A. Model Strengths and Limitations

The proposed internship recommendation system demonstrates improved accuracy by integrating multiple factors such as skills, academic performance, interests, and resume data. The use of NLP techniques helps in extracting meaningful information from resumes, resulting in better matching between candidates and job requirements. Additionally, the system provides personalized recommendations, making it more effective than traditional keyword-based approaches.

However, the system has certain limitations. It relies heavily on the quality and completeness of user-provided data. Inaccurate or incomplete inputs may reduce recommendation quality. Moreover, NLP-based processing increases computational complexity compared to simpler systems..

B. Recommendation Error Analysis

Some errors in recommendations were observed during testing. These mainly occur due to incomplete user profiles, inconsistent skill naming (e.g., abbreviations vs full forms), and limitations in resume parsing.

VI. CONCLUSION AND FUTURE WORK

Conclusion

- The proposed AI-based Internship Recommendation System provides an effective and intelligent platform for matching candidates with suitable internship opportunities. By integrating user inputs such as skills, academic performance, interests, and resume data, the system generates personalized recommendations that improve the overall recruitment process.
- The use of Natural Language Processing (NLP) and machine learning techniques enhances the accuracy of matching by extracting meaningful information from resumes and comparing it with job requirements. This reduces the limitations of traditional keyword-based systems and ensures more relevant and efficient recommendations.
- Furthermore, the system is scalable, reliable, and user-friendly due to its web-based architecture and efficient backend processing. It helps students identify suitable opportunities while assisting recruiters in finding appropriate candidates, thereby improving overall efficiency.
- Overall, the system contributes towards smarter and more data-driven recruitment by providing accurate, fast, and personalized internship recommendations.
- The system significantly enhances the efficiency of the recruitment process by automating candidate-job matching and reducing manual effort. It ensures faster, more accurate, and reliable recommendations, benefiting both candidates and recruiters.
- The system improves user satisfaction by delivering personalized and relevant internship opportunities based on individual profiles and preferences.

Future Work

Further improvements can be made to enhance the system capabilities, such as:

- Development of a mobile application (Android & iOS) to increase accessibility for users.
- Integration of advanced AI models (e.g., deep learning) for more accurate and intelligent recommendations. Inclusion of location-based filtering and live internship data for better personalization.
- • Enhancement of resume analysis using advanced NLP models (e.g., BERT) for deeper understanding of user profiles.
- • Integration with external job portals and APIs to expand available opportunities.
- • Addition of multi-language support to make the system accessible to a wider audience.
- Implementation of a feedback-based learning system to continuously improve recommendation accuracy based on user interactions.
- Incorporation of a hybrid recommendation approach combining content-based and collaborative filtering techniques.
- Enhancement of system scalability to handle large-scale datasets and increasing number of users efficiently.
- Inclusion of personality and soft skill analysis to provide more comprehensive and suitable recommendations.
- Development of a real-time notification system to alert users about new and relevant internship opportunities.
- Integration of analytics dashboards for recruiters to track candidate engagement and application trends.
- Improvement in data security measures to ensure better protection of user information and privacy.

VII. PRACTICAL APPLICATIONS

The proposed AI-based Internship Recommendation System has wide applicability in real-world scenarios across various domains. It can be effectively used in university placement cells to assist students in finding suitable internships and job opportunities based on their skills, academic performance, and interests. This helps institutions improve their placement outcomes and provide better career guidance to students.

The system can also be integrated into online job portals to enhance the recommendation process by providing personalized and relevant job suggestions to users. This reduces the time and effort required for job

searching and increases the chances of successful placement.

For recruiters, the platform offers significant advantages by streamlining the hiring process. It enables organizations to efficiently filter and identify suitable candidates, reducing manual screening efforts and improving recruitment efficiency.

Additionally, the system can be adapted for use in corporate hiring, freelance platforms, and professional networking sites. It can assist companies in talent acquisition while helping users explore opportunities that match their profiles.

Furthermore, the system can be used in career counseling platforms to guide students and job seekers in making informed career decisions. By analyzing user profiles and industry requirements, it provides valuable insights and recommendations for skill development and career growth.

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