

Name: Ahmad Moneer Mzayek

Course Title: Graduation project

Course Code: Thesis_AI900

Lecturer: Dr.Ashraf Elsayed

Hand-in Method: Online Submission via E-Learning.

University: Midocean

Assignment Report: Intelligent Job Recommendation System for Job Seekers Using Artificial Intelligence.

Abstract :

It is a challenging task for job applicants to get a suitable job since the traditional job search websites are ineffective. The websites employ keyword-based search and manual filtering, which are likely to provide wrong job recommendations. This research suggests an AI-based job recommendation system that enhances the matching process between employers and job applicants.

The proposed system will utilize Natural Language Processing (NLP) and Machine Learning techniques to analyse job listings and resumes. The model will be created using a hybrid approach, combining content-based filtering (that compares job applicants based on their qualifications and experience) and collaborative filtering (that considers the interests and actions of similar users).

To implement this system, job datasets will be gathered from open-source job postings and synthetic resume datasets.

Data pre-processing methods will be used to sanitize and structure the data for training AI models. The system performance will be gauged with metrics such as Precision, Recall, and F1-score to ensure precise job suggestion.

The expected outcome of this research is an intelligent job recommendation system that increases job search efficiency, reduces time incurred in searching for jobs that match, and provides personalized job recommendations to users. Such a system can be implemented in job portals to enable better job matching and benefit both the recruiters and job seekers.

Background and Motivation

In today's competitive job market, finding the right career opportunities that align with our interests and skills can be challenging. However, with the advancement in AI/ML technologies, we can leverage data-driven systems to provide personalized job recommendations based on user preferences and historical job data. I have been diligently trying to find a job in Riyadh for the past 11 months, but I have failed to get a satisfactory opportunity that fits my area of expertise.

My experience in sales, maintenance & operations, and business development is not easily translatable to a formal job-matching process. In addition, most companies do not adequately define their employment needs, making it difficult to identify appropriate opportunities. This has motivated me to develop an AI-driven job recommendation system that can help job seekers identify the right jobs more efficiently.

Problem Statement

Traditional job search websites rely on keyword searches, which often provide irrelevant and misleading job recommendations.

It is difficult for the majority of job applicants to find a job that matches their level of qualifications, skills, and career objectives. The majority of job applicants still employ manual applications, which include visiting companies in person and submitting their resumes. The process has several drawbacks, including:

- Making sure the resume really finds the HR staff doing the hiring.
- Securing that the resume is duly considered rather than overlooked.
- Even if the HR personnel goes through the resume, will it be interesting enough to compel them to call the candidate?

These problems translate into wasted effort and time without any guaranteed results, which annoy job seekers.

Employers can also lose best fit candidates because manual screening fails.

Therefore, a job recommendation system powered by AI is essential that enhances the efficiency and precision of job matching to make job seeking easier for job seekers and ease employers' task of identifying the best-fitting candidates.

Research Objectives

Openings to job applicants depending on their experience, skill, and interest to enhance job satisfaction Implement Natural Language Processing (NLP) and Machine Learning techniques to match job postings and cvs with more precision. Run a hybrid approach to recommendations wherein content-based filtering (matching candidates on resume) and collaborative filtering (learning trends from similar candidates) are employed. Save time spent on job hunting and improve the job hunting process by suggesting appropriate jobs.

Literature Review

1. An Intelligent Job Recommendation System Based on Semantic Embeddings and Machine Learning

The research entails the application of semantic embeddings and machine learning in improving job recommendations. The overall field of study is natural language processing (NLP) and artificial intelligence (AI) in recruiting systems. Its applicability is in increasing the precision of job-candidate matching via the application of sophisticated text analysis instead of using keyword matching.

2. Job Recommendation Enhancement using NLP and Machine Learning

This study explores hybrid recommendation systems by integrating content-based filtering and collaborative filtering. The applications of machine learning in job matching are the area of research. The contribution of this study is job recommendation personalization based on skills and preferences with reduced bias

3. Job Recommendation Analysis Using a Deep Learning Approach with NLP

This paper applies deep learning models such as word embeddings and neural networks for processing job descriptions and candidate profiles. The overall research field is recruitment automation using deep learning. The importance of this study is that it improves contextual job understanding and reduces the volume of irrelevant job recommendations.

4. Job Recommendation System using Content and Collaborative Filtering Based Techniques

This research combines content-based filtering and collaborative filtering to create a hybrid job recommendation model. It is a recommender system optimization in AI. Its significance is in solving the cold start problem by dynamical balancing of user preference and job description

5. Explainable Artificial Intelligence in Job Recommendation Systems

This study explores Explainable AI (XAI) in job recommendations with a focus on techniques like LIME and SHAP. The overall research subject is interpretable machine learning in job matching. The importance of this research is to enhance the transparency and trustworthiness of AI-based recruitment.

6. Job Recommendation Based on Recurrent Neural Network Approach

This paper suggests an LSTM-based job recommendation model, which is a type of Recurrent Neural Network (RNN). The overall area of research is deep learning applications in automated recruitment. The significance of the research is its ability to learn long-term dependencies in text data and improve the accuracy of job recommendations.

7. Job Recommendation System Using NLP

This research focuses on NLP techniques like Bag of Words (BoW), Word2Vec, and Naïve Bayes for job recommendation. The broader research area is text mining and statistical learning for job recommendations. Its relevance lies in guaranteeing fast and scalable job recommendations with constrained computational resources.

Review of Key Studies for Each File

1. An Intelligent Job Recommendation System Based on Semantic Embeddings and Machine Learning

Methodology: Utilizes SBERT embeddings and NLP techniques (TF-IDF, n-grams) to match job descriptions and resumes.

Findings: Improves the precision of job-candidate matching compared to traditional keyword-based matching.

Limitations: Computational costly and may not handle real-time situations well.

2. Job Recommendation Improvement Based on NLP and Machine Learning Techniques

Methodology: Uses Word2Vec embeddings and cosine similarity to match job postings with candidate profiles.

Findings: Hybrid filtering provides more personalized and fairer recommendations.

Limitations: The system relies on past user behavior data, thereby leading to the cold start problem for new users.

3. A Deep Learning Approach to Job Recommendation Analysis with NLP

Methodology: Utilizes deep learning models with word embeddings for job posting classification and ranking.

Findings: Offers higher accuracy by looking at job descriptions contextually.

Limitations: Requires massive computational power and enormous datasets for effective training.

4. Job Recommendation System using Content and Collaborative Filtering Based Techniques

Methodology: Uses Word2Vec, k-Nearest Neighbors (k-NN), and Pearson Correlation Coefficient (PCC) to calculate job-user similarity.

Results: Provides a 63.97% accuracy rate from 1900+ job tests and 23,000 candidates.

Limitations: Excludes resume analysis, leading to potential limitations in candidate-job matching for new users.

5. Explainable Artificial Intelligence in Job Recommendation Systems.

Methodology: Utilizes LIME and SHAP models for explanation and interpretation of job recommendations.

Findings: Facilitates more trustworthy AI-powered recruitment with transparent decision-making.

Limitations: Explainability at times reduces model performance due to trade-offs in complexity.

6. Job Recommendation Based on Recurrent Neural Network Approach

Methodology: Utilizes LSTM-based RNN models for predicting job matches from resumes.

Findings: Achieves high accuracy in matching jobs to candidates by learning sequential patterns.

Limitations: Computationally expensive and still susceptible to the cold start problem.

7. Job Recommendation System Using NLP

Methodology: Uses Bag of Words (BoW), Word2Vec, and Naïve Bayes classification for job posting and resume classification.

Findings: Provides fast and efficient recommendation system.

Limitations: Does not capture deep semantic meanings, hence there may be mismatches in recommendations.

Conclusion

The reviewed studies cover a wide range of approaches to job recommendation systems, each with strengths and weaknesses. Deep learning models (e.g., LSTM, RNN, SBERT) provide high accuracy but require substantial computational power, while hybrid filtering methods balance efficiency and personalization. Explainable AI (XAI) models enhance transparency but may reduce performance. Future research should aim to integrate **deep learning, hybrid filtering, and explainability** to create more effective and fair job recommendation systems.

Reference

- 1- <https://www.researchgate.net/publication/388741604> An Intelligent Job Recommendation System based on Semantic Embeddings and Machine Learning

Priyanka Singla, Vishal Verma Ch. Ranbir Singh University.2025.

An Intelligent Job Recommendation System based on Semantic Embeddings and Machine Learning. 2468-4376.

- 2- <https://www.researchgate.net/publication/377442387> Enhancing Job Recommendations Using NLP and Machine Learning Techniques

By Rachna Narula¹, Vijay Kumar², Renuka Arora³, Rishu Bhatia⁴.2023. Enhancing Job Recommendations Using NLP and Machine Learning Techniques. 2349-9249

- 3- chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://scispace.com/pdf/job-recommendation-system-using-nlp-2ezkunvg.pdf

Sneha Kumari¹, Gittika Agarwal², Dr. Sheshappa S.N³, Mr. Vijaykumara.Y.M.⁴, Prof. Mr. Byre Gowda B.K⁵.2023. Job Recommendation System Using NLP. 2321-9653.

- 4- chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ijscce.org/wp-content/uploads/papers/v9i3/C3266099319.pdf

Juhi Dhameliya, Nikita Desai.2019. Job Recommendation System using Content and Collaborative Filtering Based Techniques. 2231-2307

- 5- <https://essay.utwente.nl/96974/>

Thi Hoang Anh Tran.2023. Explainable Artificial Intelligence in Job Recommendation Systems

- 6- <https://www.sciencedirect.com/science/article/pii/S1877050923006804>

D. MHAMD^{1a,*}, S. OUNACER^a, M. MSALEK^a, M. Y. EL GHOUMAR^{1a}, M.AZZOUAZI.2023. Job Recommendation Based on Recurrent Neural Network Approach. 1039–1043

- 7- chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ijisrt.com/assets/upload/files/IJISRT23NOV818.pdf

Uday Jain¹, Daksh Jain², Aditya Raj Varshney³.2023. A Deep Learning Approach to Job Recommendation Analysis with NLP. 2456-2165