Survey on Virtual Recruitment System

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Abstract—**After the recent wave of covid, many companies are yet to shift their focus on recruiting candidates directly through in-campus recruitment. Many companies still do prefer the online way of conducting interviews on platforms like meet, zoom,etc. Even forms are shared to apply to a particular company and many more variable methods. Due to this rising uncertainty, the online recruitment system has started gaining more popularity. However, this procedure presents difficulties for recruiters in managing the flood of applications and maintaining contact with the applicants. Previously, such recruitment systems were inefficient and lacked many parameters like accuracy, not upgraded and not frequently managed. Therefore, there was a need to build a website which is capable of handling all the recruitment related activities. With the help of AI-ML techniques it has become possible to rank students according to the requirements of the companies. We discuss the features and research gaps for each method in applying Machine learning and other techniques for enhancing the recruitment process.**

Keywords— recruitment; recommendation; machine learning; artificial intelligence.

1. Introduction

In recent years, machine learning and artificial intelligence has significantly proven their usefulness and capacity to do anything required. Artificial intelligence and machine learning helps by making our life easier by automating tasks, storing and analyzing data effectively, and creating more smart and powerful machines. The goals of artificial intelligence and machine learning include learning, reasoning and perception. In upcoming years, usage of artificial intelligence and machine learning is predicted to grow exponentially. Artificial intelligence is used in all domains like mathematics, computer science, linguistics, psychology, space science and much more. But as we know every technology has its own advantages and disadvantages. Security is the major concern as machine learning and artificial intelligence rely heavily on huge amounts of data for its analysis. Apart from security, the development period of such systems is quite slow and expensive as there are no defined logical ways of creating such systems.

As technology is progressing and improving day by day, it is necessary for all companies to hire skilled employees to keep up with technology and competition in the market. Hiring skilled employees is a massive task and tiring process for all companies. Companies prefer to hire freshers as they are willing to learn according to the company demands and work with more efficiency. When it comes to hiring freshers for universities the companies need to scan 1000 or even more resumes for shortlisting candidates fitting into their requirements. Also the universities need to manage the recruitment process which can be hectic as there are a number of candidates looking for jobs. From maintaining contact with companies about the drive, filling forms for each individual company coming for placement, documenting and managing the selection process, announcing results and important announcements are some of the important tasks a university faces in campus placements. In most universities this process is done without using any specific software or application as a handful of these existing applications are expensive for both company and university. In most of the universities the campus placement process is carried out using physical human resources which sometimes can lead to inefficient and slow process for all.

To tackle such problems faced by universities and companies, using an application dedicated for managing records of university students, company selection process and other tedious tasks is highly preferable. As it automates the physical repetitive tasks, improves the efficiency of universities, creates strong relationships with companies and benefits the students in getting jobs in reputable organizations. These systems can be implemented using various modern technologies supporting numerous application features. Generally a web based application is preferred due to its high accessibility for all end users. Whether it is a student, university admin and company hiring manager as they all can access it anytime and anywhere. Integrating machine learning and artificial intelligence in such systems is being explored to make companies' hiring process easier and less time consuming

Current systems available in the market are less involved in machine learning and artificial intelligence and more focused on managing the data about the hiring process. A smart web based application can be implemented where secure, central storage and management of student data is provided, overall long process of selection can be handled without any hassle and use of machine learning and AI can be to smartly recommend candidates based on the company requirements, filter candidates based on relevant skill sets, and to analyze resumes of candidates for resume scoring and recommendation. There are a vast number of features that can be implemented in such systems to simplify the campus recruitment process.

2. Literature review

Suraj Gupta [1] proposed a web-based recruitment system that helps companies in shortlisting candidates based on their required skills. System gets a list of students matching the requirements of companies thus easing the work of companies. The system also helps students in knowing their placement probability based on their marks of SSC, HSC and CGPA. The system uses a random forest algorithm to predict the probability of students based on previous years placement drives.The main goal of this system is to minimize the lack of coordination between companies and students during placements and to maintain details of students.

Liu Youping [2] proposed a personalized recommendation algorithm based on a Deep Neural Network. The system has three subsystems namely talent recruitment platform backstage, campus recruitment subsystem, and social or candidate recruitment subsystem. The system asks the companies to create initial requirements of position. The model filters students who pass the minimum requirements such as education, age, university etc and then the model calculates correlation between the required position and candidates. The main goal of this system is to

solve the problem of large screening of resumes the companies receive in vast amounts of numbers thus by automatically recommending candidates based on their requirements.

Sanika Mhadgut [3] proposed smart webapp machine learning that has a unique feature of taking a virtual, brief interview of candidate using a chatbot which gets upto 5 questions filled by the recruiter. NLP is used to compare a candidate's answer to the recruiter's answer. Based on the scoring of individuals they are ranked in the leaderboard. This helps the recruiter shortlist candidates easily according to their requirements. They have tried to create a virtual application that makes the hiring process easier by taking chatbot interviews. The webapp also provides a profile section for candidates to fill in their personal details, CV screening, message and notification functionality and a job listing section with filters based on roles, languages etc. The application has two sides, first the employer side and another the candidate side. Both having their unique dashboards and many features.

Chamila Maddumage [4] proposed a web system that uses Fuzzy Inference System to rank candidates based on different criteria like resume score, automatic question generation system for measuring technical skills and soft skills. They have created an intelligent system which assists recruiters in hiring the best candidates. Their system is using various ML techniques like convolution neural network, natural language processing and fuzzy system. The main aim of their system is to solve the issue that existing machine learning recruitment systems face by making the complex decision of hiring candidates with similar scores, they solve this problem using a fuzzy inference system which has 5 sub layers in it.

Muhammad Saad Shafiq [5] proposed a system that is very effective for all over result of recruitment process that is using support vector machine classification process. There are three factors in this system namely CV submission, Personality test and ranking of CV. Ranking of applicant's CV is done with the help of the accessible list. The student's behavior test is done by a pre-trained model. A questionnaire needs to be filled and on the basis of that the system gives out most accurate results. The goal is to give useful ideas to recruiters about the applicants before the interview, by using the SVM model for classification of personalities of the candidates.

Pandithurai O [10] proposed a website for the college's placement office which will help the people to find jobs based on the resumes and skills of the job seekers. There are 3 important outlooks in this system namely jobseeker, administration, company. The applicant has to upload their resume, personal information and should give permission to location access. The applicant will be able to find jobs on the basis of location, references and types. The goal is to decrease the distance between the

applicant and job location, time saving, simple process and provides confidentiality.

Abdul Hanan Minhas [11] proposed using MCDM, a branch of operation research that studies several competing criteria in decision making; recruiters can be helped in their hunt for more qualified candidates for open positions. The Algorithm used is pruning and integrated matrix sorting to improve scalability. The candidates are ranked by comparing the feature values that includes education, skills and location with the Job description. The goal is to provide scalable and efficient recommendations

Nivedita Swapna Dhanala [12] proposed a Recruitment Management System using Blockchain. The college, institution, and law enforcement validate the information about the candidate that has been entered. The candidate information is contained in a block together with its transaction hash value, which is a distinct, preset, fixed-length text that protects the data from alteration. The recruiters read the candidate details from the blockchain after the candidate's information has been saved there, then they choose the validated candidate to move forward with the hiring process. Additionally, the security for the application for employment is provided by a smart contract that is checked by using the Ganache tool on the Ethereum platform. In contrast to the Manual Recruitment Management System, the objective is to deliver authenticated, reliable, and protected data.

Zheng Liandi [8] proposed an E-commerce Talents Online Recruitment Platform which helps students to find a job of their own choice. It is a platform where students register, search and apply for jobs and post their own resumes or certifications that can be viewed by different recruiters. The system uses ASP.NET as the main production tool which helps with the registration and authentication process. The system adopts B/S (Browser/Server) structure which integrates .NET technology and AJAX framework. In B/S structure the Browser part is mostly the frontend where the users interact with the website and Server part is where all code and maintenance work is executed. The system uses different modules to manage different work processes. The main goal of this project is to solve the contradiction between the shortages of e-commerce talents and reduce the cost of development and maintenance of E-commerce Talents Online Recruitment Platform.

Cuilin Qiu [7] proposed a Personnel Recruitment System in Higher Vocational Colleges which helps job seekers to easily find a job according to their interest skills and it also helps the companies to recruit the talent they need. It uses SSH architecture and Java for development of the system. In this system students can publish their resume that is visible to different enterprises. On the enterprise side they can see a list of candidates based on company preferences which makes it easier for the enterprise to hire new talents. The main goal of this system is to improve the efficiency of recruitment in higher vocational colleges and make the work of enterprises easy by shortlisting the talents according to their preferences

Abdulrahman Aljuaid [6] and team proposed a system which does the work of finding suitable job folders, assessing the candidates, shortlisting them based on different criteria and making the final decision. It uses Artificial Intelligence to assess the candidates and shortlist them which reduces the efforts of the recruitment team. It shortlists the candidates for interview by comparing the candidate details and the criteria specified by the company. The main goal of the system is the easy handling of a large number of candidate applications and an easy E-Recruitment process.

Shuxi Chen [9] and team proposed a Recruitment Website Data Analysis System that does the work of collecting the recruitment information from recruitment websites then analyzing the collected information and displaying the relevant information. It uses Python language and MySQL database for system development. The system consists of four modules namely Data Crawling for Extraction and collection of information, Data Storage for storing the information, Data Analysis for analyzing the stored information and Data Display for displaying the relevant information. The main goal of this system is the easy handling of Big Data and extracting the relevant information to make the work of job seekers easy.

2019, J. Kasundi [13] saw that companies do not hire positions such as leaders based on personality traits. Therefore a chatbot recommendation system is used for evaluating both technical and personality aspects of the candidate. The final system consists of four modules: Question Generation and Dialogue Flow Maintaining Module, Technical answers evaluating module, Vocabulary based Personality evaluation and Candidate recommendation. This paper also discusses the various ontologies used to store java related technical questions and answers.Since ontologies are used in RDF format, SPARQL protocol and RDF query languages are used to extract the information. For semantic analysis various methods such as euclidean distance, word2vec, doc2vec, wordnet and many more. The candidates are evaluated based on the similarity scores and categorized into 5 different classes based on their similarities.

Boukari, [14] stated in their paper that Due to the Big data era, users cannot make proper decisions based on their choices.Recommendation systems are gaining

popularity due to this very reason. With the help of Apache Spark which is a big data processing framework, the processing time and efficiency of the system is greatly improved.Potential candidates can be filtered from the renowned professional website 'LinkedIn'. This system makes use of three algorithm families: collaborative filtering, content filtering and hybrids.It finds the final score of the candidate to rank them as most favorable candidates to get placed.
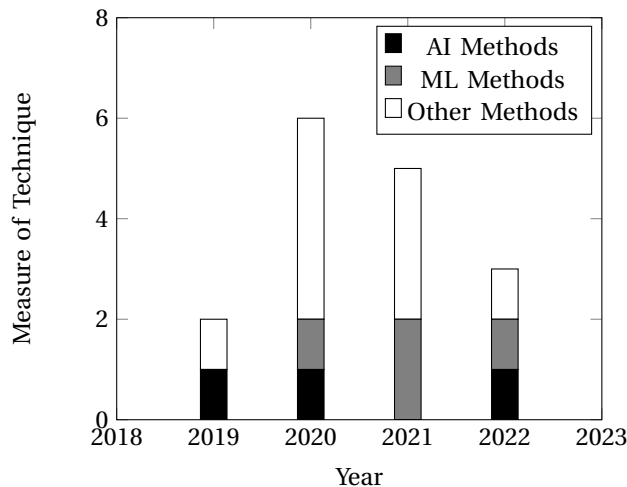
3. Conclusion

Several technologies have emerged in order to solve the problem of centralized recruitment systems. The advancement in machine learning and deep learning has allowed for the development of different powerful techniques that can be utilized to upgrade the existing experience in various ways in recruitment process. With the help of recommendation systems, the work of filtering candidates has been the easiest task compared to traditional methods. Chatbots have changed the way earlier the interviews were conducted. Subsequently, there are many other ways the recruitment process was enhanced. Artificial intelligence has a very important role in the recruitment drives recently.

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TABLE 1: Summary Table

Author Year [citations]	Techniques	Results	Research Gap
Suraj Gupta et al. IEEE 2021 [1]	Random forest algorithm	With the help of Random Forest, the lack of coordination is solved between candidates and employers.	Overall efficiency of the system can be improved.
Liu Youping et al.IEEE 2022 [2]	Deep Learning(knowledge-based screening system)	Vast screening of resumes by automatically recommending candidates based on companies requirements.	For understanding texts, NLPs can be used. Accuracy can be increased.
Sanika Mhadgut el al. IEEE 2022[3]	Sentiment analysis, Face recognition.	NLP is used to compare candidate's answers.	Custom instances of ready made questions can be added to chatbot for better user experience.
Chamila Maddumage et al. IEEE 2019 [4]	Fuzzy Inference System	Same marks are also ranked based on the Fuzzy inference systems	Existing ontology can be merged. Accuracy can be increased.
Muhammad Saad Shafid et al. IEEE 2021 [5]	Support Vector Machine	End to end solution for the recruiting process using Support Vector Machine classification.	Exploration of more features for further analysis. Increase in accuracy.
Minhas et al. IEEE 2022 [11]	Multiple criteria decision method (MCDM)	Scalable and efficient recommendations.	Finding crucial information for ranking can be improved
Aljuaid et al. IEEE 2020 [6]	Decision tree, Random forest	easy handling of a large number of candidate applications	Enhance selection process in the existing system.
Kasundi et al. IEEE 2019 [13]	Wordnet	Ontologies help in evaluating technical answers; for HR questions vocabulary evaluation is done.	Only stores java technical questionnaires.
Boukari, [14] et al. IEEE 2020	Apache Spark	Finds candidates from social media platform 'LinkedIn'	More diverse features for the recommendation system.
Dhanala et al. IEEE 2020 [12]	Blockchain	Details are stored in blocks with hash values and tested using Ganache	using permissioned blockchain technology such as hyperledger fabric networks.
Pandithurai et al. IEEE 2021 [10]	Location filtering	Filter jobs based on type, location, recommendation	features needed to make it more efficient.
Liandi et al IEEE 2020 [8]	ASP.NET	Platform to register, apply and post resumes and certifications.	Improve efficiency and reduce maintenance.
Qiu et al. IEEE 2021 [7]	Secure Shell (SSH)	Recruits in higher vocational colleges using SSH and Java	Implementing a recommendation technique
Chen et al. IEEE 2021 [9]	Web Crawler	Easily handles big Data and extracts information.	optimization of Chinese word segmentation function
Wei et al. IEEE 2020 [15]	Secure Shell (SSH)	Achieve employment of college students	The basic functions of the system can be increased, efficiency increased.