Automated Recruitment Tools: Current Trends and Further Directions

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Abstract - **Exponential and multifold increase in the requirements for diverse job profiles and subsequent flooding response for the vacancies, pose a serious limitation on the time bound manual hiring process. In such a scenario automated recruiter systems are emerging to facilitate the screening, background verification, payroll, and other administrative task which not only can save time, money, and efforts and also ensure selection of the best candidate. Artificial Intelligence powered recruiting systems are studied and presented in this research study. Role of Machine Learning algorithms like Decision trees for predicting the suitability and the performance is explored. Various current research trends and algorithmic developments are summarized and future directions are listed from the perspective of practically deployable automated recruiting systems.**

Index Terms - **Artificial Intelligence, Automated Recruiting, Machine Learning.**

I. INTRODUCTION

Automated Recruitment tools are emerging as dire need of the employers. Tools like Turbohire [1], skillset [2[, talentpool [3] and numerous others are popularly used for the process of recruitment [4].

Recruiting is the process of finding and attracting talented job seekers. The process begins with a search for new employees and ends with an application. The result is an application pool where new employees are selected. According to Edwin B. Flippo, "Recruitment is the process of finding candidates for employment.

Then encourage them to apply for positions within the organization. " Hiring is connect employers and job seekers. It's the process of discovering the source of the workforce, meet the requirements of the workforce plan and use effective means to attract them [5]. Today the recruitment industry in India alone is a 6-billion-dollar industry. The recruitment market has not only grown but had evolved into a very mature market. Employment across 9 sectors sees 29% rise in June. [Hindustan Times, January 2022].

According to Deloitte, the average cost per employment is $ 4,000. Finding a direct alternative requires 50-60% of an employee's salary. The actual cost of hiring new employees varies by region and industry, but the actual cost can be high. Their salary is not the only cost of hiring employees. This includes recruiter salaries, time and effort, training and onboarding costs, and adds to the overall cost of new hires [6]. The most common factors that contribute to the overall cost of manual hiring new employees are:

- Human Resource [HR] - Salary and Time
- Career Events, Job Boards, and social media
- Onboarding and Training
- Candidate' Salary and Bonus/Incentive
- Background verification and reference checks

Exponential and multifold increase in the requirements for diverse job profiles and flooding response for the vacancies, both pose a serious limitation on the time bound manual hiring process. Having enough human resources to facilitate effective selection of an efficient workforce which will ensure value addition to the industry/ organization is indeed a major concern of the companies/ institutes. Moreover, beyond merely, finding the suitable candidate for the desired job it is equally important to ensure that the shortlisted candidate is the 'perfect fit' and thus ultimately showcasing an intelligent or a smart choice of the recruiter.

With inevitable role played by Artificial Intelligence (AI) and Machine Learning (ML) in almost every automation and intelligent decision making, recruitment process today is no exception. AI based automated recruiting systems that include hiring,

screening, background verification, payroll, and other HR administrative works can save time, money, and efforts [8].

II. RECRUITMENT PROCESS

A typical recruitment process has few fundamental steps as listed :

- Identify the Human resources required
- Define the Job Profiles , eligibility criteria, required skillset, pay package and cost to company [CTC].
- Devise a startegy to shortlist the candidates or the recived applications (May include qualification, experience, background check etc)
- Schedule screening test, interviews – technical /personal , HR Rounds , group discussion
- Final selection process, making offers and employee onboarding.

The process flow of these fundamental steps is depicted in Fig 1. [7]. These steps are manged and systemtaically executed by trained personals from the HR team.

Every listed step in the recruitment process demands concrete investment of time and human expertise. The process of recruitment may vary depending on the job profile , company polices, market strategies defined time frames, applications made and numerous other controllable /uncontrollable factors. Nevertheless regradless of such factors the need for automation in the process is reported to reduce the hiring time, reduce the cost involved in hiring process and improve the quality of hiring. AI based recruitment software systems serves as a good facilitator to the listed steps. AI powered systems are used by HR team for initial scrutiny of the candidates – predicting the most suitable candidate from the pools, candidate engagement, tracking the performance in the selection rounds, for background checks, predicting the behavioral factors and intra-personal and interpersonal skills. Existing software, current research trends and algorithmic developments of such AI powered recruitment system are summarized in the next section.
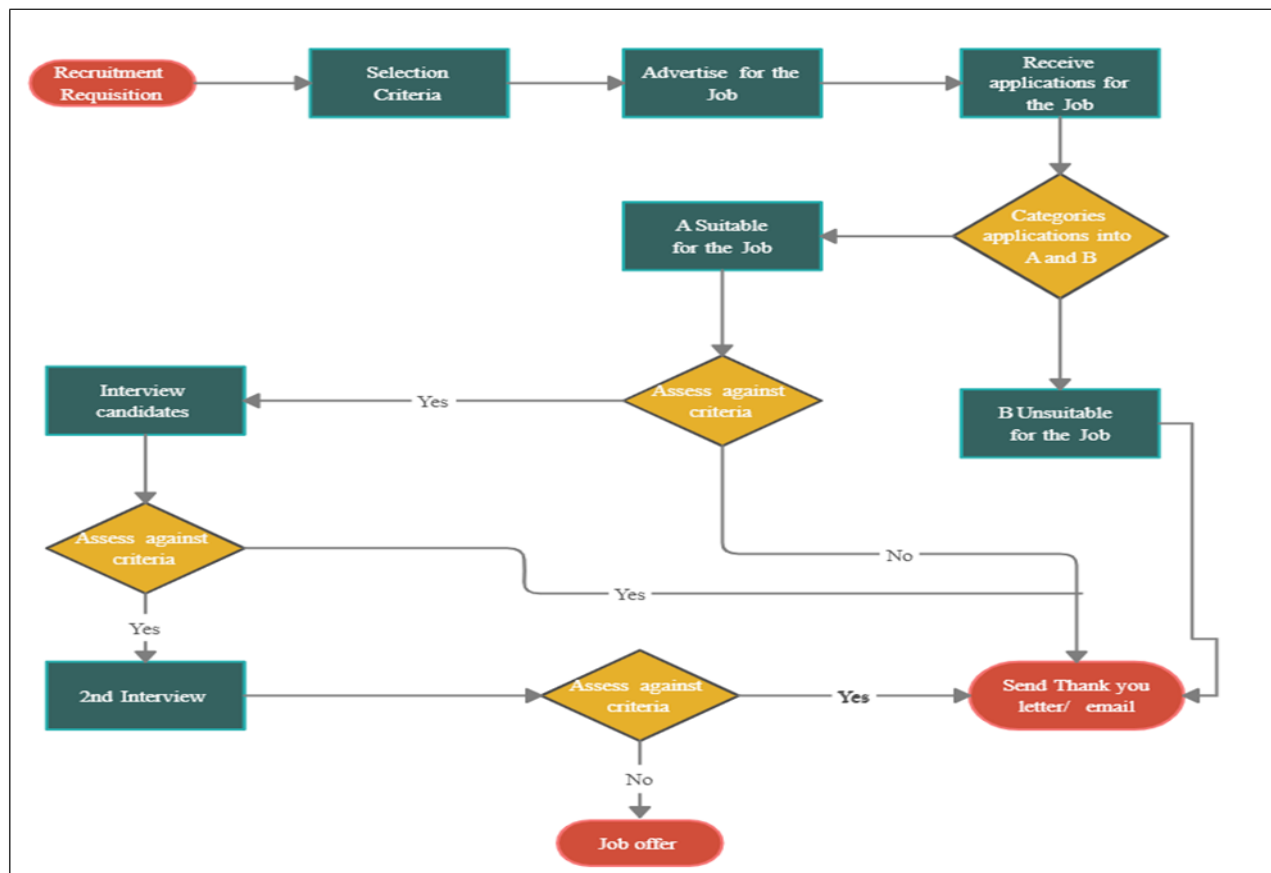

Fig 1: A Typical Recruitment Process [7]

III. EXISITNG RECRUITNG SOFTWARE

Numerous Software and Tools are designed and developed to automate the process of recruitment. Such tools source, evaluate, assess, interview, and recruit the potential candidates and facilitate faster and better decision processes.

Hiring Tools like Turrbohire claim to [1]:

- Search effectively: Search the resume Database effectively
- Multichannel sourcing
- AI assisted Screening
- Recruitment Tracking
- Talent Interview

AI Engine provides a parsing, matching and screening to provide comparative evaluation at every step and it can be seamlessly integrated. Such Tools reduce the hiring time by 78 % reduce the cost involved in hiring process by 65 % and improve the quality of hiring by 5 times.

Skillate's AI-powered solutions too are reported to automate the hiring and improve your recruitment efficiency and effectiveness [2]

Other tools like TalentPool [3] provide Assessment Management, Background Screening, Candidate Tracking, Internal HR, Interview Scheduling, Job Posting, Onboarding, Resume Parsing, Resume Search, Self Service Portal, Workflow Management and are currently being used by the companies.

Tools like Jobvite, AcquireTM, Hireology, Apploi, ApplicantStack and TalentReef are also evolving and gaining popularatity as potential alternatives to manual process of Talent Acquisation and hiring or recruiting [4]

IV. RELATED LITERATURE SURVEY

AI based automated recruiting systems that include hiring, screening, background verification, payroll, and other HR administrative works can save time, money, and efforts [8]. Such e-recruiters have advantages like lower costs per hire, shorter recruiting lead times, improved quality of candidates due to efficient selection of best candidates, better efficiency, increased convenience for recruiters and clients, and shift of focus on effectiveness [9,10]

Saranya et al. devised an AI based tool to duplicate manual process and exhibit human level expertise to accomplish the recruitment task with appreciable accuracy and effectiveness [11]. The system was tested on recruiting companies and large datasets and claimed to achieved the desired benefits.

Siew et al. [12] designed and developed a handwriting analysis system for career guidance: "My Analyser". The designed handwriting analysis or graphology system recommends the possible suitable occupations based on the personality types and traits. The developed system achieved 76.14 % accuracy for identifying the personality traits 82.95 % accuracy for recommending the occupations. Such a system is of vital importance during the pre-screening or scrutinizing the applications in automated recruiting software. While selecting the candidate for the desired profile having a match with the occupations suggested by "MyAnalyzer" will add a confidence score in the selection process.

Ashish et al. [13] presented a system based on graphology for automated prediction of human behavior. Some sensitive, high profile and extremely responsible job profiles demand rigorous analysis of behavior of the candidate before shortlisting them. The devised approached incorporated various parameters including size, slant, word spacing, pen pressure, line spacing, upper and lower zone loops to identify the personality traits which are reported to play a major role in automated recruiting systems. The devised system provides encouraging results however needs further experimentation from the perspective of practical deployment considering the background noise and artifacts in the images.

Geetha et al. [14] researched the role, importance and impact of AI in current recruiting process. The study highlights the techniques used by recruiting industries / companies in AI. They include secondary sources of information like conceptual papers, various peer reviewed journal articles, books and websites. The research revalidates the effectiveness of automated, AI powered system for recruitment and outperform the manual process.

Ali et al. [15] presented a Machine Learning based Performance predicting system for hiring and performance-appraisal Age. The devised system incorporated features like Age, Gender, Marital Single, No. of Kids, university of graduation, type of university of graduation (Public, Private) specialization if any, No. of Working, No. of Previous Companies the employee worked for and earlier

Employee's Job. Experimentation in three phases was carried out with entire dataset in the first phase and then the datasets obtained from two companies in the second and the third phases. The study concluded justifying the need of additional research to bridge the gap in the current automated recruitment process.
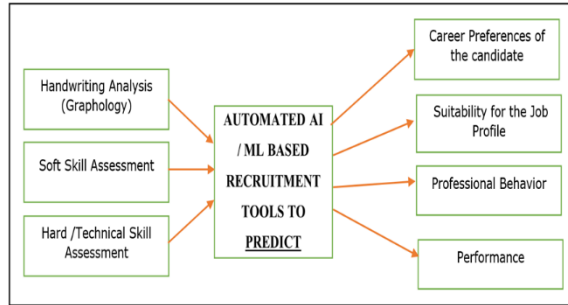

Fig 2: Automated Recruiting system

Another interesting study reported by Mau et al. [16] examines the factors influencing the Science Technology Engineering Mathematics [STEM] career interest. Such factors are guided by Social Cognitive Career Theory [SCCT] and are directly/ indirectly examined during manual process of hiring. Measurement and incorporation of these parameters will play a vital role in the success of automated recruitment process to identify the best fit for the job and will replicate the manual or human-expert driven recruitment drives.

Luo et al, [17] reported similar finding after researching the interests of the students in STEM career. Taking a note of the interest of the candidate in the job profile is of paramount importance beyond merely considering the eligibility /suitability of the candidate for the job. This aspect has received meager attention in the current automated system for recruitment. Additional research in this direction is therefore a dire need from the perspective of practical deployment.

Current research trends are also focused on predicting the career of the students using advanced AI and ML based algorithms. Decision Trees and Random Forest algorithms are explored by Vidyashreeram et al. [18]. Similar research experimentations are also explored by Bendangnu et al and Kachi et al. [19, 20]. The results of the designed systems are reported to facilitate the hiring agencies / Recruiters in selection of best suited profiles.

With encouraging success of the current recruitment software, full and reliable automation of the parameters and process depicted in Figure 2 are now gaining importance and attention of the researchers. incorporation

V. DISCUSSION AND CONCLUSION

Availability and selection skilled workforce directly contribute to the economic growth of the nation. With exponential growth in the job vacancies and emerging new job profiles, the pool of candidates interested to apply and explore the opportunities is also increasing enormously. The manual process of shortlisting and selecting the right profiles is time consuming, depends on the knowledge and experience of the trained personal and is prone to human errors. Automated Hiring system and recruitment software are therefore popularly preferred due to its numerous advantages and are attracting the research community.

Literature reports various design and development of various automated systems that are validated using datasets and questionnaire from companies. While lot of attention is paid to predicting the behavior, suitability and performance of the candidate, other factors like measurement of soft skills and hard skills have received relatively less attention. As depicted in figure 2, an integrated system that takes in account job profile , company polices, market strategies defined time frames, applications made and numerous other controllable /uncontrollable factors is of outmost importance when considering full and reliable automation in the recruitment process. Additionally, one must also consider the effects of STEM stereotype, self-efficacy and outcome expectations in the recruitment process. Objectifying all the aspects and parameters during the dynamic recruitment process is very challenging and therefore demands further research and exploration of advances strong AI and ML approaches before their practical deployment in the real time scenario.

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