Robot Recruiters: The Rise of Artificial Intelligence in Hiring Practices

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Abstract

This review analyzes the different perspectives on leveraging artificial intelligence (AI) in corporate hiring practices. Particular attention is applied the rationale behind using the technology in this context, as well as its benefits and outstanding issues for both human resources workers and candidates applying for employment. The paper will first describe the general nature of artificial intelligence. Then, it will outline current obstacles faced by the human resource management (HRM) field, and the ways that AI usage could potentially alleviate such obstacles. It will then examine evidence of significant flaws in AI and how these flaws may be contradictory to the goals of the larger HRM field. Finally, the paper will acknowledge the potential usefulness of AI in recruiting while maintaining that further research and development of the technology is required before widespread implementation. This literature examined in this review may prove particularly useful for companies deciding whether to pursue AI-based updates to their hiring practices, as it outlines the many potential advantages and challenges associated with AI-based hiring tools.

Origins of Artificial Intelligence

The phrase “artificial intelligence” was first introduced in 1955 by a computer scientist named John McCarthy. McCarthy—a prodigal mathematician and developer of early programming

languages— formulated the term to describe how complex tasks normally undertaken by humans can be translated into precise ideas, problems, and methodologies that can be replicated by machines [1]. McCarthy's earliest explanation of artificial intelligence briefly addressed some of the most popular facets of artificial intelligence in practice today: neuron nets (more commonly known as neural networks), automatic computers and automation, and computational "self-improvement" (frequently expressed today as "machine learning").

The artificial intelligence most commonly seen in practice today is aligned with the ideas posited by John McCarthy's paper—algorithms focused on solving complex tasks that, in the past, have normally fallen to humans. With the mass proliferation of the internet, there is now more data available about our world than ever before, and further, an eternal need for infinitely advancing technologies and features. Through this data, AI can be developed. And with the need for new, more efficient technologies, AI continues to be ferociously pursued. AI has already been applied to a wide variety of fields and purposes including (but not limited to) finance, agriculture, health, entertainment, and communication. It is the logic behind spam filters, online shopping recommendations, credit approvals, and more [2][3][4].

Obstacles of HRM

Of particular interest to many businesses is the applications of artificial intelligence in human resource management (HRM). Professor Stefan Shrohmeier, Chair for Management Information Systems at Saarland University in Germany, describes HRM as "a subset of management tasks that are related to potential or current employees to obtain contributions that directly or indirectly support the strategy and performance of an organization" [5]. One significant responsibility of workers in HRM is employee recruiting and retention. In recent years, the importance of this

particular responsibility has increased dramatically. One survey conducted by the Conference Board research group discovered that “attracting and retaining talent was a top strategic priority for CEOs” [6]. Recruiting hasn’t always been so highly prioritized. Recent economic circumstances, however, have compelled companies to devote greater resources to hiring and employee retention. The historically low unemployment rates in the United States over the past few years have impacted employers’ abilities to locate available new hires with advantageous skill sets. And since employment is so strong, employees are more willing to leave their current positions to seek out opportunities elsewhere. In 2016, the Society of Human Resource Management reported that the cost to hire a new employee using traditional HRM practices is approximately $4,129, with forty-two days marking the average time it takes to fill an open position [7]. A departing employee or open position of any kind therefore represents a significant financial burden on the company, as well as on the HRM workers’ time. With the difficulty in finding new hires presented by the current unemployment rates, it is logical and judicious for companies to seek out tools that optimize the hiring process and increase the likelihood that new hires stay with their organization. Patrick van Esch and J. Stewart Black of the Kelley School of Business also note that “the basis of competitive advantage has shifted from tangible assets to intangible assets. Intangible assets now account for roughly 80% or more of firm value, up from just 17% in 1975.” Company employees are grouped into the category of intangible assets, and are also considered “the principal driver” of those assets [6]. Thus, to maintain a “competitive advantage,” HRM must seek to grow these intangible assets—in other words, they must hire more workers.

Benefits of AI in HRM

Finding the Right Candidate

Esch and Black mention the "talent shortage" presented by the low unemployment rates in the current economy [6]. Despite this talent shortage, over 50 percent of recruiters "report that sifting through potential candidates is the hardest part of their work." This is largely attributed to the digital internet age we currently occupy. Thousands of under qualified candidates can apply to positions at the click of a button. Recruiters must then sort through these résumés, and if recruiters fail to find a satisfactory candidate within the pile, they must then search through hundreds of millions of candidate profiles on sites like LinkedIn, travel to college campuses, or conduct extensive in-person networking [8].

Artificial intelligence algorithms are poised to simplify and optimize this workload. In 2015, researchers revealed a "Content-Based Recommendation Algorithm...to quantify the suitability of a candidate for a specific job position." This algorithm can supposedly identify top candidates based on their measured fulfillment of certain prioritized attributes/skills that are specified and ranked by recruiter creating the posting. When people apply for the position, they are immediately scored on the skills that the recruiters is pursuing. This system would eliminate the need for recruiters to sort through all résumé submissions, as many applications would be immediately disqualified in favor of higher-scoring candidates [9]. This algorithm operates similarly to many other existing algorithms, though the attributes of seemingly "ideal" job candidates are usually determined using datasets on supposedly "successful" employees who filled the role in the past.

Recruiters could also leverage these algorithms to seek candidates that did not necessarily apply to a role. Autonomous programs, otherwise known as "bots," can be utilized to scrape social media sites for candidate data, which can then be processed and scored. If the candidate seems to be a good fit, the recruiter can then reach out to see if they're interested in pursuing the role. This capability is especially helpful in our current world of millions of job postings, as it's easy for candidates to miss or overlook roles that may actually suit their ambitions. Additionally, bots can analyze social media data to determine if potential employees will behave professionally, or seem likely to leave the company shortly after starting. To make such determinations, recruiters would have to again use social media data from past "successful" employees to set target measures for their new hires [10].

Even subsequent steps can be handled by artificial intelligence. A company called FirstJob has effectively developed a chatbot called Mya which can ask candidates follow-up questions [10]. Consumer goods giant Unilever recently pioneered an almost entirely AI-based intern recruiting process that imports and analyzes candidate profiles from LinkedIn, ultimately narrowing down the list of potential candidates by over 50%. Remaining applicants are then asked to play a series of strategically designed games which test for sought-after skills, and are then required to complete a video interview on HireVue. HireVue is a virtual interview software that utilizes standardized sets of interview questions, facial recognition programs, and algorithms that scrutinize the interviewee's vocabulary and voice. It is only after a candidate successful meets algorithmic requirements in all three steps that they finally participate in an in-person interview. With the other 60% to 80% of candidates automatically (and algorithmically) rejected, the remaining candidates have an 80% probability of receiving and accepting an offer. Automating so much of the process drastically decreased hiring costs, as well as allowed recruiters to

consider candidates from 2,600 colleges—far more colleges than HRM resources previously allowed [11].

Eliminating Bias

Many corporations and researchers believe that AI is capable of eliminating bias in the hiring process. Allan Schweyer, President and Executive Director of the Human Capital Institute, notes that "Human bias and error often cause high quality applicants to be missed or passed over before the interview stage" [8]. Human bias, particularly racial, ethnic, and gender bias, is an unfortunately pervasive factor throughout human-driven hiring processes. One American study by researchers Bertrand and Mullainathan sent fake résumés to various newspaper classifieds. The skills and experiences listed on the résumés were identical. The only differentiating factor between résumés was the candidates' names—they were either stereotypically white-sounding name, or a stereotypically African-American-sounding names. The study discovered that the résumés with white-sounding names were 50% more likely to receive interview requests than the résumés with African-American-sounding names [12].

The tech industry in particular seems to suffer from a lack of diversity that stems from gender and racial biases. In one survey, 88% of women working in Silicon Valley confirmed that they continue to experience sexism and unconscious bias from their co-workers. Another study revealed that when tech companies are filling an open position, their candidate pool excludes all women 53% of the time [13].

Obviously, these studies reveal concerning trends that need to be addressed. Many people, like Schweyer, believe that AI is the answer, thinking that AI can be programmed without these biases entirely, thereby improving the hiring process and corporate diversity [8]. Kimerly A.

Houser, Assistant Professor at Oklahoma State University, insists “the responsible use of artificial intelligence...can mitigate unconscious bias by reducing the impact of human decision-makers on the process… and create better employment decisions which are based on skills, traits and behaviors rather than factors (such as sex, race, or pedigree) that do not correlate with merit or success” [13]. In the case of analyzing résumés and the name-based discrimination described above, AI would analyze all résumés in terms of their listed skills and experience while programmatically excluding factors such as name, age, or sex.

Improving Hiring Experiences

Interestingly, utilizing AI has improved candidate interest and satisfaction in the hiring process. Candidates are often frustrated as they wait to hear back from companies, and HRM workers are often too busy with other responsibilities to provide constant updates to every single applicant. Mya, the aforementioned chatbot developed by FirstJob, has proven to be quite successful at conveying application updates to these candidates whenever they are requested, thereby removing this frustration and yet another burden on HRM workers [8]. One study even reported that advertising the use of AI in hiring processes may make candidates more likely to apply to those positions due to the novelty of the idea and the interest in being judged objectively throughout the interview process [14].

Risks and Limitations of AI in HRM

Quantifying Success

AI is so attractive to corporations because, as aforementioned, it automates and optimizes complex tasks that normally fall to human beings. It is worth noting, however, that these tasks

are considered complex for a reason. How is a company to determine what traits constitute a "successful" employee? One research paper published by Wharton University discusses this dilemma:

> A first problem is the complexity of HR outcomes, such as what constitutes being a "good employee." There are many dimensions to that construct, and measuring it with precision for most jobs is quite difficult: performance appraisal scores, the most widely-used metric, have been roundly criticized for problems of validity and reliability as well as for bias, and many employers are giving them up altogether. Any reasonably complex job is interdependent with other jobs and therefore individual performance is hard to disentangle from group performance. A vast literature documents numerous problems with existing performance systems as well as our field's failure to establish a clear link between individual, team, and organizational performance. Given the uncertain quality of performance evaluations by humans, can we use them for training AI algorithms? Even if a high level of accuracy was achievable, this would mean scaling up arbitrary or outright discriminatory human decisions. [15]

This viewpoint highlights several important considerations that may skew measures of employee "success," the role that group work had to play in worker performance, the accuracy issues associated with appraisal scores, and the essentially "arbitrary or outright discriminatory" way we score workers' accomplishments [15].

If it's difficult for humans to quantify what makes a "good employee," surely it must be difficult to properly program those attributes into an algorithm. In fact, it's often argued that there's no real way to choose traits that embody what makes an employee successful, as it might vary from role to role, time period to time period, person to person. Chris Forman, CEO and Founder of popular job ad placement application, Appcast, expressed concerns that too many other factors influence employee performance, saying that "the idea that you can always predict who will do well—at least in their first year—is flawed because so much depends on the manager and other variables" [8].

It would be easier to accept a company's measures of "good employee" qualities if there were data to support that these candidates performed as well or better than past employees after accepting an offer. Companies who use AI in recruiting—such as Unilever—have not yet released such results, instead focusing on the HR time and money saved using the software.

Mistrusting the Data

If recruiters don't choose to use arbitrary measures of employee fit, they may instead elect to use machine learning algorithms. Machine learning in the case of HRM would need to absorb large datasets of past and current employee information. Machine learning algorithms would use these data points to determine patterns in the data—patterns, for example, regarding what attributes make an employee valuable to a particular company. This would eliminate the need for recruiters to explicitly specify what they think constitutes a good employee based on limited, personal experience, and instead relies on relationships derived from a substantial number of data points [15]. Using data in this manner can also be problematic, unfortunately, as many AI systems don't explain the patterns behind the decisions they make, which makes it difficult to critically examine whether the AI has developed logical patterns of picking employees [10]. If this "explanability" is not present in the AI's hiring decisions, legal violations may actually occur, as employers are legally required to be able to provide reasons why a candidate was or wasn't hired.

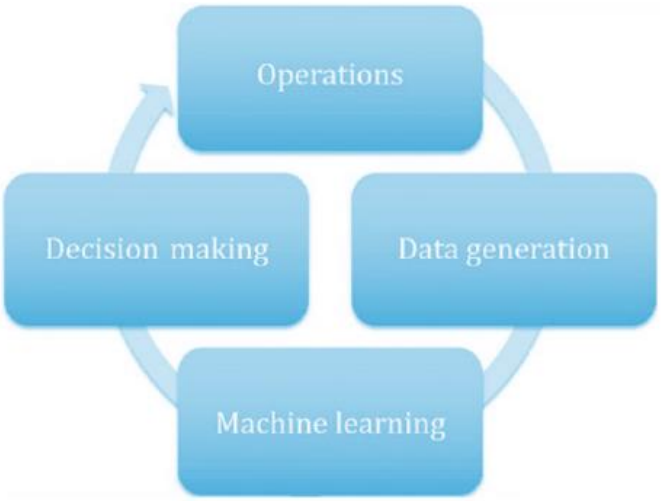

Figure 1. “The life cycle of an AI-supported HR practice” [15]

Of major concern with this method is the very problem that algorithms hoped to fix: bias. Specifically, racial, ethnic, and gender bias. Algorithms are never as objective as they seem. If a company has historically hired Caucasian males, then those data points will influence what the AI considers to be a predictor of success. Meanwhile, non-white, non-male candidates might be perceived as non-conforming to that predictor of success, and overlooked or rejected by the algorithm [10].

The most infamous example of algorithmic bias is Amazon’s maligned machine learning hiring algorithm, the development of which began and 2014 and was discontinued in 2018. The algorithm was trained using résumés from the past decade of Amazon’s hiring records. Sadly, because these résumés primarily belonged to men (thanks to existing bias in the previous hiring processes) the algorithm ranked male-related qualities as desirable qualities. The ranking of women’s résumés by the algorithm suffered from this preference, with the algorithm able to “pick up on minute differences, like resumes that used the word ‘women’ such as ‘women’s

soccer' or graduates of women's only universities." The bias for male candidates was so prevalent in this algorithm—as well as its training data—that Amazon was forced to cancel the project and assure the public that the system was never actually used in real hiring situations [16].

Even IBM—one of the biggest corporate advocates for AI in hiring and creator of the famous AI Watson—admits "there is nothing about AI that magically reduces biases. AI technology can be used to reduce bias or, if we aren't careful, reinforce it" [17].

Conclusions

A great deal of literature on AI in hiring is convinced of the necessity of its use and immensely optimistic about its impact on the fairness, effectiveness, and efficiency of current recruiting practices. Upon reviewing this literature, it is evident that there are, in fact, many hiring-related tasks that could benefit from the help of AI. AI also has the capability to widen applicant pools, as evidenced by the Unilever intern hiring process [11], and has demonstrated some ability for making the hiring process more enjoyable for candidates [8][14].

Other supposed benefits of AI, such as reducing bias, are more highly contested. The idea that AI can prevent human bias is, at the current time, largely hypothetical. Artificial intelligence algorithms "are at risk of discriminatory output if developed using inaccurate, biased, or unrepresented data because algorithms learn by example" [18]. Most companies likely won't have huge, highly accurate datasets on past employees, and attempts to scrape social media for that data might collect "posts that are typically designed to create an image of the individual that is different from reality: entries about vacation cruises far outnumber entries about doing the

laundry even though most of us spend far more time on the latter than the former" [15]. Reportedly, training datasets for AI can avoid biases only if "the training data are sufficiently noisy," meaning that it contains a lot of useless, perhaps even corrupted, information. This useless information prevents the sort of skewing that Amazon experienced with their mostly-male hiring history. It is unclear whether corporations like Unilever utilized noisy datasets despite the fact that they practice AI-based hiring. Amazon, meanwhile, will likely have to revisit how to construct noisy datasets.

From this information we are able to determine three important areas of research to develop the future of AI in HRM:

1. More research is required to determine if AI-produced hires are at the same level or better than employees that are hired using traditional HRM practices.
2. More research is required to outline how employers should accumulate large, "noisy" datasets to prevent bias.
3. Existing AI-hiring systems must be evaluated for embedded biases.

Research in these areas will ensure that HRM practices continue to improve without introducing bias or incorrect measures of employee fit.

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