

**Facilitating the search for Off-Grounds Housing at UVa**  
(Technical Paper)

**Why do Artificial Intelligence based hiring systems, which include both the technology and the people that interact with it, result in hiring that might seem inequitable at times?**

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## **Aspects of AI hiring systems that are failing**

### **General Research Problem**

*Why do Artificial Intelligence based hiring systems, which includes both the technology and the people that interact with it, result in hiring that might seem inequitable at times?*

Recently, there was a lot of controversy over how Amazon utilized Artificial Intelligence to evaluate candidates in the hiring process. The training dataset that they used was revealed to give a lower rating to resumes with the word “women” in them compared to those that did not have that keyword. After further analysis, it was concluded that since the tech industry is often male dominated, the dataset they used was biased towards resumes that were presumed to be mens’ giving an unfair advantage to this demographic (Kodiyan, A. A. , 2019). While Amazon stopped using this tool to evaluate resumes, it brought up the important question of how AI should be used in the hiring process. While AI is helpful in evaluating large numbers of candidates, the potential bias it can create needs to be mitigated in order to use these tools to hire candidates in a more equitable manner (Ghosh, 2017).

### **Evaluating the datasets and algorithms behind AI hiring systems**

*How do the quality/quantity of data and the different common machine learning models affect the accuracy and fairness of predictions made by an AI hiring system?*

There are two main aspects to how an AI hiring system is built: the datasets and the algorithm. Developers often create algorithms based on artificial intelligence and natural language processing to evaluate virtual interviews and resumes. These algorithms rely heavily on datasets in order to train the models to make accurate predictions about hiring decisions. However, if the datasets are biased towards a certain demographic, the predictions about hiring decisions will also be biased towards that

demographic. Similarly, the algorithms created and tested by the developers are subject to bias based on the people who develop it. In order to create a more equitable system, the question of which specific aspects of the system (including datasets and algorithms) are failing must be answered (Nugent, S. E., & Scott-Parker, S. , 2021).

While it is well known that datasets and algorithms affect AI systems, it is often hard to pinpoint where exactly the problem lies as these systems vary so widely and details about systems are often privately held by companies that develop them. Additionally, even when these aspects of the system are evaluated, they are evaluated in terms of their accuracy of predictions rather than their fairness and equitability. My project will involve the analysis of datasets and algorithms that are commonly used in AI hiring systems. To conduct this analysis, I will make use of open-source Applicant Tracking System (ATS) software which companies often utilize to make hiring decisions. Although these systems might not be the exact ones that companies use when hiring, they provide a groundwork for algorithms and datasets that are commonly used in the hiring industry. Additionally, many of the machine learning models that are used in AI hiring systems are available through open-source machine learning software libraries like Tensorflow and PyTorch, so these libraries can be used to verify the results of the algorithms used in the AI hiring systems. I can find datasets of common hiring candidates that are open-source and use them to conduct tests with the machine learning software that is available. Therefore, the ways in which datasets and algorithms affect fairness in hiring can be analyzed through the modeling of these AI hiring systems with open-source ATS software and machine learning software libraries.

### **Stakeholders' effect on the fairness of hiring decisions made by AI hiring systems**

*How do the interactions that hiring managers and testing populations have with AI hiring systems affect the fairness of the hiring decisions that are made?*

While the algorithms and datasets that are used in an AI hiring system affect the fairness of hiring decisions, people's interactions with the system are often overlooked as a source of bias. For example, many companies claim to use a hiring manager to "correct" the AI's bias when making hiring decisions, as they believe humans are better decision makers. However, Houser claims that this actually introduces more bias that AI aims to eliminate (Houser, K. A. (2019). In fact, Houser claims that AI can actually help improve the fairness of hiring decisions. While this is not a very popular opinion amongst AI critics, Houser makes a fair point about the people involved in AI hiring systems and how much of an effect they have on the hiring decisions made. Therefore, it is important to evaluate how stakeholders interact with and affect AI hiring systems to improve the fairness of the hiring decisions that are made.

Many AI hiring systems are used in conjunction with hiring managers whose goals are mainly to hire the right candidates for the company. A hiring manager could mitigate the bias that AI hiring systems can introduce; however, many of these managers are biased themselves due to unconscious biases. The involvement of hiring managers could reinforce the AI's biases or add new ones, both of which pose a risk to fair hiring decisions. Additionally, it is important to examine to what extent hiring managers make the hiring decision in comparison to the AI system. There is a vast difference between a hiring manager that makes the decision by just following the AI's decision and a manager that makes the decision based on multiple factors (Black, J. S., & van Esch, P., 2020). Interviewing various hiring managers at technology companies and gathering information on different companies' hiring standards/practices can help evaluate to what extent AI is involved in the hiring manager's decision.

Another main stakeholder involved in an AI hiring system is the population that the system is tested on. To develop an accurate system, it must be trained using a training dataset and tested using a testing dataset. If either of the datasets are subject to bias, it could lead to hiring decisions that are biased towards a certain demographic (such as men in the case study of Amazon's AI hiring system). To curate

a testing dataset that is representative of the population that it is being tested on, it is important for the developer to analyze the hiring candidate population. However, many times the algorithm is not tested properly on a dataset that is diverse and representative of the population that it will eventually be used on (Houser, K. A. 2019). Additionally, how this is tested and who it is tested on tends to be a point of disagreement as various companies do this in different ways. Surveying different companies based on what AI hiring system they use would be a good start to answering the question. Most companies hire 3<sup>rd</sup> parties to develop the algorithm and test it, so looking into these 3<sup>rd</sup> parties and what kind of testing data they use can also help. Identifying correlations between the datasets used to conduct testing and the fairness of hiring decisions will be essential to analyzing AI's effect on the hiring population.

To answer the question of how stakeholders' interactions affect an AI hiring system, it will be important to examine multiple case studies of companies that use these systems. Mainly, it is important to compare the fairness of hiring decisions that are made with solely the AI system and that of the hiring decisions made in conjunction with the hiring managers. This will have to be done through qualitative analysis of the decisions made. As part of this analysis, fairness metrics will have to be developed to analyze different companies hiring practices using the same standards. This can help conclude if hiring managers are helping or hurting when making hiring decisions involving AI.

Overall, studying how hiring decisions are made in conjunction with hiring managers and how the system is tested amongst hiring candidates will serve to answer the question of how stakeholders' interactions with AI hiring systems are failing. By identifying these failures, steps can be taken to ensure that they are mitigated in the future so that hiring decisions can be made in a more equitable manner. Unfortunately, disproportionately represented groups in certain industries (for example, women in tech) are often affected by unfair AI hiring systems, therefore identifying how it is failing in conjunction with the stakeholders can help mitigate this issue.

## **Conclusion**

In conclusion, there are both technical and non-technical issues involved in the failure of AI hiring systems when it comes to making unfair decisions concerning minority groups in certain industries. Technically, there are issues with the datasets and algorithms that are used to train the AI hiring systems in making hiring decisions. However, even if these issues are solved there is still the issue of how stakeholders such as hiring managers and hiring candidates affect the hiring decisions that are made. Examining these effects in more detail can help pinpoint the failures of the hiring system so that it can be improved in terms of making more equitable hiring decisions. While making an accurate hiring decision is important, the fairness of it must also be considered so that industries can foster a more inclusive environment that is representative of diverse groups.

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