Technological Connection: Improving Resource Access through Technology
(Technical Paper)

How Does AI Contribute to Already Existing Bias in the Technological Hiring Process?
(STS Paper)

A Thesis Prospectus
In STS 4500
Presented to
The Faculty of the
School of Engineering and Applied Science
University of Virginia
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Computer Science

By
Emily Buerk

October 27, 2022

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.

ADVISORS

Daniel Graham, Computer Science

Bryn E. Seabrook, PhD, Department of Engineering and Society

Introduction

Currently, women make up only 24% of the technology work force (Cveticanin, 2019). Many companies are working to combat this in their hiring programs by creating retention programs and hiring at conferences for women in tech like the Grace Hopper Conference (*Grace Hopper Celebration*, 2019). However, some of their hiring practices such as the machine learning algorithms created to filter through applicants were unintentionally trained to accentuate gender bias and therefore widen the gender gap in tech. In 2019, Amazon was found to be using one of these algorithms that preferred male candidates for their technical positions (Dastin, 2018). At a large and influential tech company like Amazon, the practice of using biased algorithms is a troubling sign for the next generation of female computer scientists.

The issue of bias in tech, however, does not only affect the female software engineers searching for jobs, it also negatively affects the corporations by cutting off potential innovative and diverse groups. Additionally, lack of diversity in the workforce negatively affects consumers of technology who are not seeing their own values represented in the creation of the products that they are using. Products such as Amazon Alexa, Google Search, Apple's Siri, and Facebook Algorithms that were created by companies lacking representation across groups lack the diverse mindset that leads to inclusive engineering. Technology must be inclusive and helpful for people of all different backgrounds, and must not be designed to solely benefit the few who created it.

Machine learning algorithms such as these hiring algorithms that are trained and used incorrectly disguise themselves as easy solutions while making our preexisting issues worse. Issues such as racial injustice, wealth distribution gap, and gender bias are also exemplified by machine learning algorithms. By using machine learning as a replacement for human beings

without understanding its repercussions in the hiring process, we are taking away opportunities to utilize technology to enhance human skills and connection. I will provide additional research on the issue of machine learning bias in the tech hiring process in my STS research paper.

In the technical project I will explore how to lessen the effects of poverty in the Charlottesville area by connecting people to resources provided by charitable organizations. In Charlottesville, the U.S. Census shows that 23.1% of residents are under the poverty line (U.S. Census Bureau, 2021). Poverty in communities is linked to increased homelessness and hunger in children in youth (American Psychological Association, 2009). The poverty rate in the United States also disproportionately affects marginalized ethnic groups and people of color. In order to combat this inequality in the Charlottesville area, my team designed a website to connect people in our community with resources from non-profit organizations that will help people struggling with poverty to mitigate the effects of poverty in their lives.

Technical Topic

Poverty is a sensitive issue which greatly affects our community in Charlottesville, Virginia. The citizens of Charlottesville face a variety of struggles that I will analyze in the technical report. In the technical portion of the STS project, my team further investigates these discrepancies in the population of Charlottesville and the factors that contribute to the poverty rates in the community. The specific problem statement is that "Charlottesville families do not have access to reliable housing and sufficient food options."

Much of the Charlottesville community is shaped by the University of Virginia. With over 17,000 undergraduate students alone, the university has a strong presence in the community (U.S. News & World Report, 2021). The university hosts many programs for giving back to the community such as free community classes, tourism income, and students paying taxes. However, this relationship is not strictly beneficial for the community. The university community will still negatively impact the poverty level in Charlottesville, with transient students using up community resources. One such phenomenon is the correlation between university students raising the poverty rate in their communities by populating off-campus housing which increases housing costs for the community (U.S. Census Bureau, 2019). The non-profit organizations in the city also have their own difficulties that are also explored and optimized in the report.

The goal of the technical project is to create a website that will connect people below the poverty line in the Charlottesville area to the appropriate resources that they need. The main feature of the site is a matching quiz that collects anonymous data from the user and utilizes existing information on nonprofits to pair up the user with nonprofit resources based on their eligibility. The matching quiz will also utilize artificial intelligence to suggest corresponding nonprofit resources and articles to inform the user. In addition to the matching quiz, the site displays resource eligibility data on each nonprofit in the area and provides filters to sort through this data. Therefore, the product is centered around information transparency and is built to connect people to helpful organizations.

STS Topic

Machine learning algorithms exacerbate pre-existing discrimination in the tech industry. When these algorithms are trained and used incorrectly, they magnify the problems of today's world. With the creation of new technology comes the promise of solving increasingly challenging problems. At the same time, this new technology complicates already existing issues with additional challenges.

One such application of machine learning is language processing. Following trends in the digital age, many large corporations have shifted to automating hiring processes using language processing algorithms. The hiring algorithms were intended to eliminate human bias by replacing workers with machines that can easily sort through resumes to select candidates. However, these algorithms are trained to worsen the already existing biases in company hiring practices and in effect widen the gender gap in tech.

My STS paper will analyze the hiring algorithms that perpetuate the gender gap in technology. I will utilize the Social Contract Theory (SCT) to dive deeper into the creation of biased algorithms and the obligations of all corporations to use technology responsibly. The Social Contract Theory describes the moral or political obligations that members of a society implement through some sort of contract, whether established formally or not (Friend, n.d.). Essentially, the Social Contract Theory describes the phenomenon of people in a society adhering to a rule as justification for the rule itself (D'Agostino et al., 2017). I will use this ideology to explain why it is essential to ensure that technology must be created by many different people that are representative of a society so that their collective opinions will form the rules of the society.

Modern social contract theories are attributed to philosophers Thomas Hobbes, John Locke, and Jean-Jacques Rousseau (McCartney & Parent, 2015). Two large critics of the SCT are feminists and race-conscious philosophers. As a feminist, Gauthier argues that we must see relationships between entities as two-sided rather than having one system controlling another (McCartney & Parent, 2015). Race-conscious philosophers argue that societies are not held accountable for their racially-motivated crimes under the Social Contract Theory. The theory does not account for theories in the racial contract which state that many societies create rules based on racism (McCartney & Parent, 2015). Other critics of the SCT believe that it allows the government too much power in creating legislation that is blindly accepted by citizens who have trouble opposing rules (McCartney & Parent, 2015).

The Social Contract Theory as applied to the discrimination in machine learning hiring practices is important to understanding how to go about closing the gender gap in tech. A report on the current state of the gender gap in technology stated that women are dropping out of technology roles at a 45% higher rate than men, which is why we need to fix current hiring practices and work on retention policies and fair treatment in the workplace (Maynard, 2021). When today's world is heavily reliant on technology, it is important that diverse teams are creating technology that is accessible and beneficial for its diverse users. The machine learning algorithms in big tech hiring practices are not the only issue causing the gender gap in technology, yet it is certainly an important step in the work to correct the gender gap in tech.

Research Question and Methods

In the STS paper, I will be further examining how artificial intelligence contributes to already existing bias in the technological hiring process. In order to understand more about the usage of artificial intelligence and the causes of machine learning bias, I will use articles and research papers that dive deeper into these topics. I will find these sources by looking for news in the AI and ML space that describe new uses of these technologies to explain the general applications. From there, I will find articles that detail the current applications of machine learning to hiring practice by using keywords like "hiring bias," "hiring algorithms," and "automated hiring tools." This will narrow down the AI technology to those specific to the hiring process. In order to determine the cause of data bias, keywords like "bias cause," "data bias," and "algorithm bias" will explain more about the accumulation of bias in technology. Utilizing articles on the current state of hiring bias as well as research papers on the causes of bias in this area will adequately fill out the information necessary to understand bias in technological hiring practices.

Conclusion

In order to solve the issues of hiring bias and poverty, we must first understand them. In my STS research paper, I will explain the accumulation of bias in machine learning, its effects on hiring practices, and the mitigation of such discriminatory practices. In order to close the gender gap in tech, the biased hiring practices must be understood and fixed. More representation in the tech field will ultimately aid in the creation of more equitable technological solutions. In addition, my technical report will feature research on the cause and mitigation of poverty in the

Charlottesville area. This project will ultimately connect people in poverty with the nonprofit resources that they need to aid their living situations and mitigate the effects of poverty in the Charlottesville area. I am passionate about both projects and their outcomes that will affect the lives of the many users of technology and residents of Charlottesville.

References

American Psychological Association. (2009). Effects of poverty, hunger and homelessness on

children and youth. *Https://Www.apa.org*.

https://www.apa.org/pi/families/poverty#:~:text=Poverty%20is%20linked%20with%20ne

gative

Cveticanin, N. (2019, November 14). *28 Women in Tech Statistics: Girls Get Tech*. DataProt.

https://dataprot.net/statistics/women-in-tech-statistics/

Dastin, J. (2018, October 10). Amazon scraps secret AI recruiting tool that showed bias against

women. *Reuters*.

https://www.reuters.com/article/usamazon-com-jobs-automation-insight/amazon-scrapsse

cret-ai-recruiting-tool-thatshowed-bias-against-women-idUSKCN1MK08G

Friend, C. (n.d.). *Social Contract Theory | Internet Encyclopedia of Philosophy*. Social Contract

Theory.

https://iep.utm.edu/soc-cont/#:~:text=Social%20contract%20theory%2C%20nearly%20a

s

Grace Hopper Celebration. (2019). Grace Hopper Celebration. https://ghc.anitab.org/

Maynard, P. (2021, March 3). *Council Post: Are We Really Closing The Gender Gap In Tech?*

Forbes.

https://www.forbes.com/sites/forbesbusinesscouncil/2021/03/03/are-we-really-closing-the

-gender-gap-in-tech/?sh=5b9459015d71

McCartney, S., & Parent, R. (2015). 2.9 Social Contract Theory. *Opentextbc.ca*.

   https://opentextbc.ca/ethicsinlawenforcement/chapter/social-contract-theory/#:~:text=Pro

   blems%20with%20the%20social%20contract

U.S. Census Bureau. (2019, May 23). *When Many College Students Live Off Campus, Poverty*

   Rate Goes Up. The United States Census Bureau.

   https://www.census.gov/library/stories/2018/10/off-campus-college-students-poverty.html

U.S. Census Bureau. (2021). *U.S. Census Bureau QuickFacts: Charlottesville city, Virginia*.

   Www.census.gov.

   https://www.census.gov/quickfacts/fact/table/charlottesvillecityvirginia/RTN130217

U.S. News & World Report. (2021). *U.S. News & World Report: News, Rankings and Analysis*

   on Politics, Education, Healthcare and More. Usnews.com. https://www.usnews.com/