Thesis Project Portfolio

Exploring Boundaries Between Art and Technology: The Role of AI-Generated Art in the Traditional Art Market

(Technical Report)

Examining the Prevalence of Gender-Exclusive Technology and Developing a Strategy to Combat Bias

(STS Research Paper)

An Undergraduate Thesis

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In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis
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Level II

Building Dashboards and Battling Bias: How To Be an Ethical Engineer

Technology wields enormous power over society. From the invention of the wheel to the innovations that led to the Industrial Revolution, technology has brought about both positive and negative changes in the world. To better understand the gravity and responsibility of being an engineer, the STS program has guided me through the complicated relationship between innovation and ethics. Holding engineers accountable for the consequences of their work is challenging due to the collaborative nature of engineering, making it even more important to personally hold oneself accountable. Engineers must consider the end user in the design process in order to understand how their product could be used and to embody being an ethical engineer. I illustrate my grasp of this in my technical project and STS research. For my technical project, I produced a log analytics dashboard during a summer internship. I took on this project because of my passion for computer science. My STS research explored gender bias in technology and developed a strategy to identify and combat such bias. This topic has always stood out to me as someone who has been affected by gendered technology before even knowing what the term entailed.

The technical portion of my thesis produced a Spark jobs dashboard that displayed log analytics in an easily consumable manner. Spark is a framework that is configured on EMR (a cloud big data platform for running large-scale applications) and can be used for data processing, machine learning, and other analytics tasks. Every time a Spark job is run, a log report is generated and used by customers in case of troubleshooting. For larger companies, hundreds of

jobs are run every minute, meaning hundreds of log reports. Additionally, Spark is a preconfigured framework, meaning that companies and individuals that use Spark do not need to be experts in how Spark works. As a result, troubleshooting could be time-consuming and confusing. To streamline the troubleshooting process, I created an automated process that parsed log reports for data and inserted that data into a dashboard that I designed. In the dashboard, the user was able to search logs by keyword, filter by date, error type, severity, error ID, and more. Additionally, the dashboard provided graphs that updated in real-time to show statistics that could be useful in quickly identifying areas of trouble. Using the Spark jobs dashboard, Spark engineers can address errors much faster, decreasing downtime and improving the customer experience. This project is meaningful to me because it provided me my first real-world experience as a software developer. I learned to design project guidelines and documentation, work with industry tools, and most importantly how to incorporate feedback from peers. In school, projects focus on the technical aspect of software development, but this project placed more emphasis on listening to the intended audience and designing around their needs.

In my STS research, I studied the lack of gender inclusivity in STEM technology. Much of modern STEM technology, ranging from virtual software and algorithms to items in the physical world such as cars and medicine, is designed with a one-size-fits-all mindset, except that “one-size” is based on the average man. I highlighted examples of this phenomenon to show the consequences of designing in this manner. Then, I used actor network theory to identify key actors in the sociotechnical system that had influence over gender bias in technology and mapped the relationships between the actors. Using the network, engineers can trace all the different relationships an artifact may hold within society and use that when considering if bias is present and if there is, what actors it can address to fix that bias. My research aims to encourage

engineers to be more aware of the possible consequences of their work. This research is meaningful to me because the findings of the research directly relate to my quality of life, as well as women all over the world.

At a quick glance, my technical project and research topic are not related at all. However, a closer look reveals that they serve as an example and counterexample of engineering with an STS perspective. In my technical project, the features, accessibility, UI, and other functions of the dashboard were specifically tailored to the user's needs. I knew that the intended user might not be tech savvy since customers did not need to have an engineering background to use Spark, so the dashboard had to be intuitive. To achieve this, I spoke with several experts to determine vital information that needed to be displayed and tested my dashboard on my peers. In contrast, my research topic presents several examples of disregard for user needs when creating new technology. My research presents the lack of consideration for female users and shows what happens when an engineer fails to fully consider who they are designing for. Overall, my project emphasizes the need for the creation of technology that respects diversity and accommodates different needs. By following STS principles, engineers can better anticipate how technical and social components interact and produce work that is ethically sound.