

Thesis Project Portfolio

Participatory Design: Data Model Management Application

(Technical Report)

**Participatory Design as a Solution to the Ethical and Legal Implications of Algorithmic
Diagnosis in Medical Imaging**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Gary Tillman Dean

Spring, 2023

Department of Computer Science

Table of Contents

Sociotechnical Synthesis

Participatory Design: Data Model Management Application

The Ethical and Legal Implications of Algorithmic Diagnosis in Medical Imaging

Prospectus

Sociotechnical Synthesis

Introduction

Both my STS research project and technical capstone focused on the implementation of participatory design in the software development process. My STS research project took a much larger view of a more complicated area of software development, while my technical report focused on my specific experiences with applying this framework at my internship from this past summer. As an intern at the time, the framework of participatory design was not mentioned by name, but after learning about it during my STS classes this year, I was able to reflect on the project and see how did apply it in many ways to our project. In particular, I realized the emphasis we placed on engaging with the different teams within the company that our application was going to be used by. Our design process lasted half of the summer, with the other half dedicated to development.

STS Project

My STS project centers on the issues that have arisen and will continue to arise from the application of machine learning image recognition algorithms to medical imaging analysis. Specifically, I highlight issues of bias, trust, and data privacy. For example, minority groups are, as they are in the general population, often underrepresented in datasets used to train algorithms, leading to decreased accuracy for their images. I talk about how algorithms like these are notoriously hard to tweak or change, due to their black-box nature and their unsupervised training process. To address these issues, I discuss how principles of the framework participatory design could be applied. I argue that by following these principles, many practical solutions can be reached such as increasing representation on development teams, gathering balanced datasets, and involving doctors and patients in the design process of the algorithms. While the framework

is not a catch-all solution for the ethical concerns explored, I argue that it can be a positive step towards solving many of them.

Technical Report

Last summer, a large McLean, Virginia-based financial company decided to streamline the complicated, manual process of adding new data models that wasted tons of man-hours. As an intern, I worked on a team was tasked with creating an enterprise application to onboard new data models and view existing models. To accomplish this goal, we built a full-stack application using a combination of Python and Vue.js, that would be deployed on AWS and connected to a DynamoDB database. We spent an extensive time designing the application, involving all affected teams in the process. At the end of the summer, our application was deployed to a development environment and was able to perform the basic features we outlined. To bring the application into use, the database needs to be fully populated with the necessary data, and the application needs to be deployed through the pipeline into a production environment.

Conclusion

Working on these projects at the same time has been extremely valuable to me, as it allowed me to have insights on their connectedness that I otherwise would not have had. If I had not decided to work on participatory design, my technical report would have been a much more dry and technical paper focusing strictly on the development of our application. Looking back over my experiences through the perspective of this framework allowed me to better understand what things my team did that were successful and why they were successful. At the time, my team's extended design process without getting to start coding frustrated me, but now I realize that process was invaluable in creating an application that meets the needs of those intended to engage with it. These realizations will inform my future work of developing software.