First Draft Outline for Capstone Project

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1 Introduction

This section will present the overall goal of my work, using data science to advance and help communicate personalized medicine. I will introduce "CoralMD" as a prototype dashboard designed to integrate genomic, wearable, lifestyle, and electronic health record (EHR) data. I'll also discuss in this section will how there is a current problem in which healthcare today is often reactive and one suit fits all, whereas CoralMD aims to provide proactive care.

2 Context and Background

Here, I will define personalized medicine and summarize its current progress, such as the use of genomics in cancer care, decreasing sequencing costs, and the growing role of wearable health technology. I'll probably go a little further on wearables, explaining how ones like WHOOP have a pace of aging clock. I will also review challenges identified in the literature I've highlighted in my bibliography, such as including bias, data insecurity, inequity, and lack of interpretability. Finally, I'll look to place CoralMD within broader research like the scene of healthcare and discussions in the field of personalized medicine, genomics, and early detection.

3 Description of the Data

This section will explain the sources I am working with, including genomic data, wearable datasets, and EHR data that will all be combined and put together (like it is a coherent dataset of the three) for the prototype. I will also discuss the challenges of integrating these sources, particularly bias, missing data, and sensitivity of health information, while outlining how the project will use mock data responsibly but with a design intended for scalability. I will hopefully have made enough advancement where I can describe a greater dataset that I have trained my ML models on, but we will see given the scope.

4 Needfinding and Ethical Pillars

I will describe the four guiding needs that shape my project: trust, true representation, data security, and interpretability. This section will highlight why these pillars are essential for building a platform that clinicians will adopt and patients will trust. Essentially I will highlight what needs to be different than other platforms for it to work.

5 Ethical Challenges and Considerations

This section will expand on the potential risks of the project. I will focus on bias due to underrepresentation in genomic and wearable datasets, accuracy issues such as false positives and negatives in risk predictions, and how presentation of results might influence clinician trust and patient outcomes. I will also address questions of equity and access, such as which institutions or populations will benefit from a system like CoralMD. I will propose safeguards including the use of explainable models, careful visualization design, a privacy-first data handling approach, and carefully made sharing policies.

6 Methodology and Analysis

This section will describe the technical approach, including integrating the datasets, applying machine learning for risk prediction and anomaly detection, data visualizations, and focusing on interpretable outputs rather than black-box scores. I will also explain the decisions made regarding analysis, such as evaluating models for both accuracy and fairness, and describe the prototype dashboard development process.

7 Concept and Demo

Here, I will present the CoralMD prototype interface. This will include a walk-through of how a clinician might see an individual's profile, with risk factors highlighted, trends displayed, genetic data on display, and anomalies flagged. I will make sure to show how the system ties back to the ethical pillars I mentioned earlier.

8 Discussion and Reflection

This section will place my project in the context of personalized medicine more broadly, reflecting on what the prototype demonstrates about the potential of data-driven personalized care. This section will also note the limitations of the current work, particularly the reliance on mock data and the scope that comes with a single semester project, while suggesting broader implications for the possibility of moving forward.

9 Conclusion and Moving Forward

Finally, this section will recap the project goals and outcomes. I will outline next steps such as scaling data integration, incorporating doctors feedback, and working toward validation in the industry. I will have to emphasize the importance of balancing the new tool with responsibility, ensuring that CoralMD is designed not only to be powerful but also to be ethical and equitable!