Practicum Project Proposal

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1 AREAS OF FOCUS

1.1 Unit(s) of Focus

My unit of focus will be Health Applications in ML/Cloud.

1.2 Topic's Primary Area of Focus

My topic's primary area of focus is Machine Learning/AI for Health.

1.3 Secondary areas of focus

My topic's secondary areas of focus are Chronic Illnesses (Diabetes) and Healthcare Burdens.

2 BACKGROUND AND SIGNIFICANCE

2.1 Diabetes

Diabetes is a chronic medical condition characterized by consistently high blood glucose levels, which can lead to complications (e.g., eye and kidney damage) if untreated (WHO, 2013). Diabetes is a prevalent condition in the United States, affecting about 34.2 million people in 2018 (CDC, 2020). In addition to the medical complications that patients with diabetes may face, diabetes is a significant public health cost burden, estimated to have cost $327 billion in 2017 (ADA, 2020).

2.2 Hospital Readmissions

One major area where the cost burdens of diabetes manifest themselves is in hospital inpatient care (ADA, 2020). Thus, minimizing hospital readmissions for patients who have received hospital care for diabetes is an important avenue to reduce healthcare costs. A hospital readmission for diabetes can be due to a number of potential factors, including patient medication adherence, inadequate patient support, poor patient understanding of their disease, and others (Rubin, 2018). Reducing hospital readmission rates for diabetes could reduce healthcare costs and improve the patient experience. Furthermore, understanding the factors that influence hospital readmission rates, and being able to predict hospital

readmission rates from available clinical features, could inform strategies to reduce readmission rates.

3 PROBLEM

The problem that I am studying is hospital readmission for patients with diabetes. There are many clinical and non-clinical features that may impact a patient's hospital readmission risk. Furthermore, understanding these factors may inform standard or patient-specific strategies to mitigate hospital readmission. Specifically, my problem will be to predict hospital readmissions for patients with diabetes and, if possible, suggest strategies to mitigate readmissions based on the results.

4 PROPOSED SOLUTION OR IDEA

I will leverage a dataset from Strack et al. (Strack et al., 2014), which contains 100,000 instances and 55 attributes, which is obtained from the UCI Machine Learning Repository (UCI, 2014), to train predictive models of hospital readmission. This dataset contains patient-level features that may be predictive of a hospital readmission as well as the hospital readmission outcome (whether the patient was readmitted in less than 30 days, more than 30 days, or not readmitted).

4.1 Modeling

My solution will combine exploratory data analysis and predictive modeling. First, I will explore and visualize the data to better understand the meaningful patterns. Then, I will leverage machine learning algorithms to predict patient-level hospital readmissions from the available features. Using models like decision trees and random forests will also enable me to determine the relative importance of the available patient-level features, and thus may inform interventions that could reduce hospital readmissions.

4.2 Reducing Readmissions

After completing the data analysis and predictive modeling, I will propose strategies that could reduce hospital readmissions for diabetes patients. These strategies will be informed by a literature review as well as the direct results from the modeling I do using the hospital readmission dataset. Thus, my solution aims to be something that could be implemented by hospitals or health

systems to reduce readmissions and thus improve patient outcomes, experience, and reduce health costs. My approach will consider healthcare policy by informing standardized strategies that can be implemented by healthcare providers. Furthermore, my proposed solutions must be useable across a variety of hospital and health systems. Thus, my solution may face difficulties in implementation and effectiveness across diverse hospital settings, which must be accounted for in how it is deployed and the improvements we could expect to see from it if it were deployed.

5 COMPLEXITY OR EFFORT

The complexity involved in this project will stem from data pre-processing, data exploration, modeling, and solution ideation/creation. First, the data will need to be cleaned, visualized, and processed into a form such that predictive models can be effectively applied. Then, a solution will be proposed and outlined, with the goal of hospitals and health systems being able to implement the solution into their workflows and thus reduce hospital readmissions.

Specifically, I anticipate the complexity/effort of this project to involve:

- Data pre-processing, exploration, and visualization: 2 weeks
- Predictive modeling, evaluation, and analysis: 1 week
- Suggested interventions and solution development: 2 weeks

6 TENTATIVE TEAM MEMBERS AND ROLES

I will be the only team member on this project. My role will involve data processing and analysis as well as the training and testing of machine learning models.

7 REFERENCES

[1] ADA (2020). *The Cost of Diabetes*. URL: https://www.diabetes.org/resources/statistics/cost-diabetes.

[2] CDC (Feb. 2020). *National Diabetes Statistics Report, 2020*. URL: https://www.cdc.gov/diabetes/library/features/diabetes-stat-report.html.

[3] Rubin, Daniel J (2018). "Correction to: hospital readmission of patients with diabetes". In: *Current diabetes reports* 18.4, pp. 1–9.

[4] Strack, Beata, DeShazo, Jonathan P, Gennings, Chris, Olmo, Juan L, Ventura, Sebastian, Cios, Krzysztof J, and Clore, John N (2014). "Impact of HbA1c measurement on hospital readmission rates: analysis of 70,000 clinical database patient records". In: *BioMed research international* 2014.

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[6] WHO (Nov. 2013). *About diabetes*. URL: https://web.archive.org/web/20140331094533/http://www.who.int/diabetes/action_online/basics/en/.