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Introduction

Non-communicable diseases dominate disease burden within the developed world; diabetes has the seventh largest disease burden in the United States and continues to grow year-by-year (GBD, 2019). Like most non-communicable diseases, diabetes differentially affects people based on genetic, community, and lifestyle factors that potentiate the development of diabetes. To advocate effectively for diabetes as a public health burden, one must determine the communities most affected by it, the underlying medical risk factors that increase the likelihood of development, and its current maintenance and treatment methods. In this capstone project, Group 5 is creating a holistic narrative of the disease burden of diabetes in the United States from a public health perspective. First, CDC, Census, and Department of Agriculture data are used to determine who is most affected by diabetes, including special interest explorations of race, ethnicity, sex, age, income, food security, and exercise. Second, the Rui-Ci Health Center's diabetes and medical characteristics dataset is used in machine learning models to predict the underlying physical characteristics that coincide with diabetes diagnoses, emphasizing the connection between community demographics and health manifestations. Third, deep learning techniques are used on Jaeb Center blood glucose traces to develop a tool for tracking and alerting diabetic individuals of blood glucose spikes, thus creating a holistic view of diabetes patients pre- and post-diagnosis. All project methods emphasize the use of cheap data science techniques to refine and target diabetes disease burden control within the United States, with special emphasis on creating a holistic view of diabetes from a public health perspective. The findings of this project can then be used for efficient and effective targeted advocacy for those most affected. As such, the following questions around diabetes care are answered:

1. Which demographics are most likely to develop diabetes in the US?
2. What measurable bodily attributes contribute to the indication of diabetes?
3. How are diabetes patients' blood glucose levels tracked in real time?
4. Which demographics are exhibiting higher spikes in blood glucose levels?
5. Looking at specific regions within the US, how do different lifestyles contribute to diabetes prevalence?
6. Does food scarcity impact diabetes incidence?
7. Can we predict diabetes diagnoses based on readily available medical vitals, such as blood pressure, mineral levels, and body mass index?
8. Can we predict warning notifications for dangerous blood glucose spikes based on real time blood glucose levels of Type-1 diabetes patients?

Datasets

Dataset Source	Significance
National Health and Nutrition Examination Survey from CDC via Kaggle	A CDC program of studies designed to assess the health and nutritional status of adults and children in the US
Aerobic Activity by State, from CDC	Shows data from each US state and overall national data for the percentage of total respondents who are aerobically active for at least 150 minutes per week
U.S. Chronic Disease Indicators: Diabetes from CDC	Shows the prevalence of diabetes in each state as well as the prevalence of diabetes by race and ethnicity
Incident of Diabetes in Adults from Rui-Ci Health Care	A Chinese dataset containing over 200,000 datapoints for unique patients regarding medical vitals and Type-2 diabetes diagnoses; often used for prediction of diabetes diagnoses based on other medical manifestations
Continuous Glucose Monitoring (CGM) Data from Jaeb Center for Health Research	Contains CGM data from a research study on patients with Type-1 diabetes; glucose readings are taken every 5 minutes over a 26-week period for each patient
Food Security in the US via the US Department of Agriculture	Shows food security issues on a state-by-state basis
Place of Birth by Educational Attainment in the United States via the US Census Bureau	Shows levels of educational attainment for each state in the US
Income in the Past 12 Months (In 2020 Inflation-Adjusted Dollars) via the U.S. Census Bureau	Shows income brackets for each state and the percentage of the total state population that resides within that bracket

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