Research Experiences for Teachers and Young Scholars in Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST)

Applying Machine Knowledge to Human Glucose Issues

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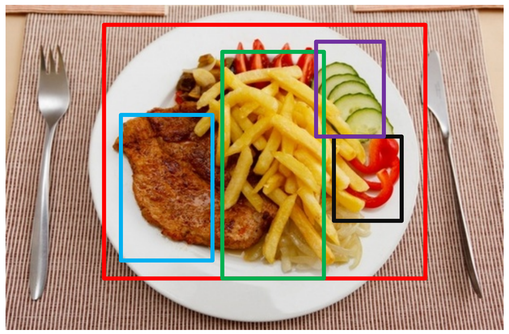
Introduction

At least 1.25 million people have type 1 diabetes worldwide today, and at least 40,000 people receive a Type 1 diagnosis each year in the United States. There are ways to dose insulin, but it can sometimes be a challenge. Training blood sugar sensors and predictors using machine learning techniques may benefit people with diabetes. It can also be used to help train a predictor. This predictor would be able to recognize the amount of food on a plate and, using the current blood sugar, be able to tell them how much of the food they would be able to eat, without insulin, and keep their blood sugar in the normal range. This predictor would make calculating insulin dosage much easier than current techniques.



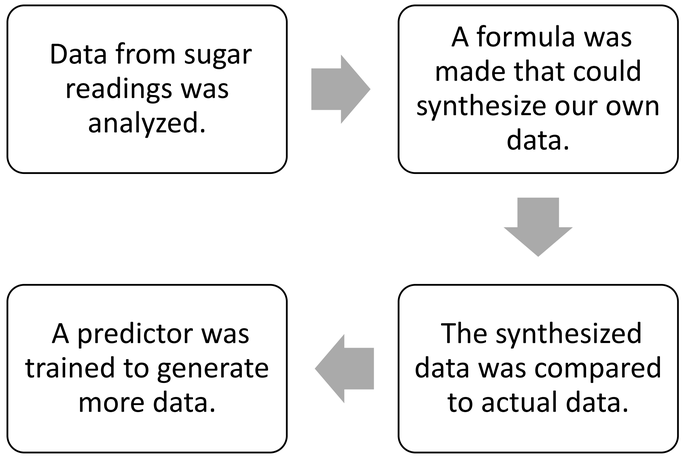
Background / Motivation

I wanted to come up with a way to help people that live with these problems all around the world. Sensors like the Freestyle Libre and calculator applications like Carb Manager are available, but require the patient to estimate amounts of food and manually input these amounts This machine learning approach would eliminate much of the guess work.

Figure 1: Freestyle Libre Sensor

Figure 2: Carb Manager App logo

Method



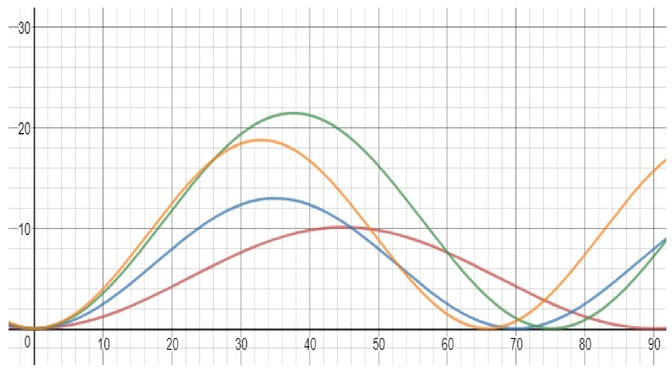


Figure 3: This is a graph that shows the relationships between foods with the same carbohydrates and foods with the same glycemic index.

The green and the orange line both have the same glycemic index. They rise at the same rate, but the green line has more carbs, and therefore rises higher and stays in the blood stream longer. The blue and the red line both have the same carbohydrates. The blue line has a higher glycemic index, so it rises faster and wears off sooner. The red line has a lower glycemic index, so it rises slower and stays in the blood stream longer. If the foods have the same carbohydrates, the area under the curve will be the same. So the blue and red lines both have the same area under the curve.

The machine was trained to learn the formula that we made. If the machine could correctly generate data, then it would prove that this predictor could be individualized to more people. It would use their data to learn the person.

Results

Once the predictor was fully trained, we got data after 50 epochs. There was an error that occurred, and only 113 / 20,000 data points responded incorrectly. That's .565% of the data points. Another point was 324 / 50,000 and 675 / 100,000. So the predictor trained was about .63% inaccurate.

Future Work for Others

For future work, I would love to make this predictor a reality. I would create an app that has a database full of foods and their carbohydrates. It would be synched up to a glucose monitor so it knows the current blood sugar. Using the phone, the person would take a picture of the food and the app would recognize it and calculate the total amount of carbs. Then, using the blood sugar, it would tell the person how much of the food they could eat, while keeping their glucose at a normal range, without using any insulin. Individualized health care would also be possible.

References

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