Gray Box Modeling for Improved Accuracy of Glucose-level Prediction for the Artificial Pancreas

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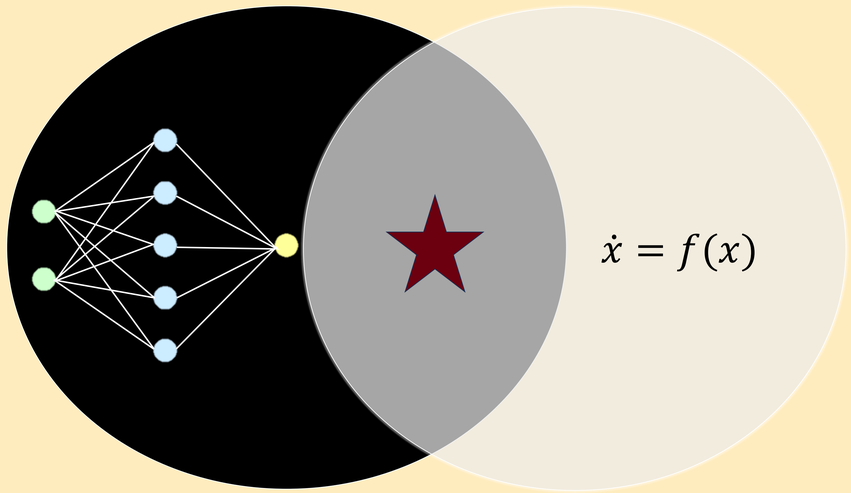
INTRODUCTION

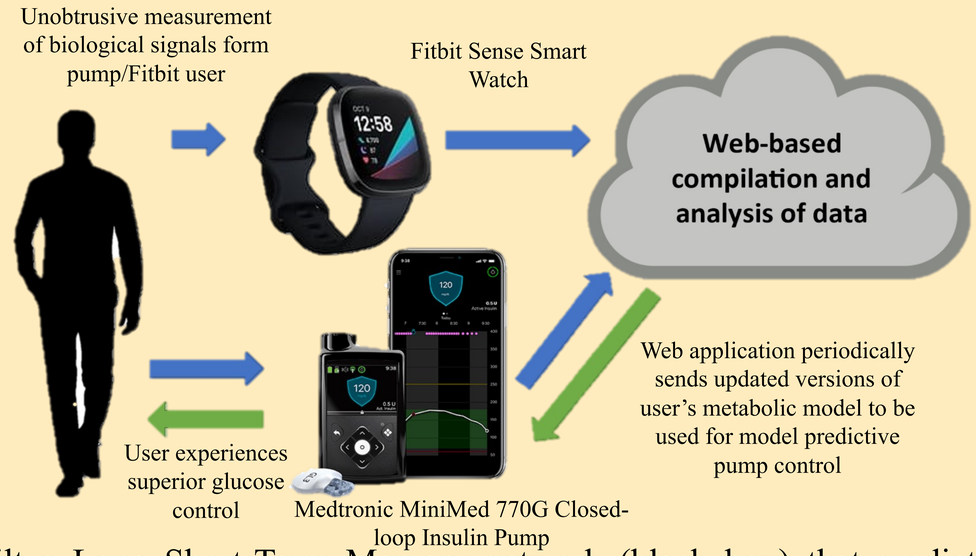
Diabetes is a widespread health condition that affects millions of people around the world. Many individuals rely on a closed-loop insulin pump system (aka Artificial Pancreas – AP). Controlling the AP depends on having an accurate model of the human metabolic system that is also computationally compact (not too complex) – a difficult balance to strike. Existing models, used for AP control, fail to model personalized blood glucose trends[3]. We want to develop a personalized model of the human metabolic system to better predict glucose levels for the improved use of an artificial pancreas.

METHODS



We have built a neural network model (black box) that predicts the user's glucose levels based on the biological signals available from an apple watch and a continuous glucose monitor. Using the Dalla Man Model[1,2] (white box), we can describe how the system evolves over time. Although, setting the parameters for these equations requires extensive knowledge or assumptions about an individual's physiology. The combination of these two models will create a "gray box model" which balances explainability with performance.

NEXT STEPS



We have built a Long Short-Term Memory network (black box) that predicts the user's glucose levels based on the biological signals. Next, we will obtain glucose predictions based on the Dalla Man model of the human metabolic system (the white box prediction). We will show that the fusion of these two predictions will result in a more accurate glucose reading. This improved model will allow us to develop advanced control strategies for the artificial pancreas.

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