Using Machine Learning to Predict Postprandial Blood Glucose in Type 1 Diabetics

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People with Type 1 Diabetes must compute an insulin dose for every meal. Dosing errors can cause both acute and chronic complications. The current dosing method (i.e., "carb counting") considers only the amount of carbohydrates in a meal. This project used machine learning techniques to examine the effects of prior blood glucose dysregulation, exercise, and food composition on postprandial blood glucose levels. Accurate prediction of postprandial blood glucose will enable accurate insulin dosing. During a 30-day period, insulin infusion rates, blood glucose levels, and heart rate were continuously measured using an insulin pump, continuous glucose monitor, and a smartwatch. The size and composition of each meal was recorded. Using this data, variables were created to characterize prior blood glucose dysregulation, exercise, and meal composition. The Weka machine learning toolkit was used to train models that used these variables to predict postprandial blood glucose levels. The models predicted two-hour postprandial blood glucose levels with a correlation of R = 0.74. By contrast, carb counting achieved a correlation of only R = 0.35. Combining carb counting with a one-hour postprandial blood glucose measurement achieved R = 0.64. This project created models for postprandial blood glucose prediction that will enable patients to optimize insulin bolus doses to achieve target postprandial blood glucose levels. This project demonstrated that prior blood glucose dysregulation, exercise, and food composition all have significant effects on postprandial blood glucose levels and that one-hour postprandial blood glucose measurements can enable tight glycemic control.

Awards Won:

Fourth Award of $500