

Using Spatial Analysis and Forecasting to Manage Type 2 Diabetes Conditions (GH-Method: Math-Physical Medicine)

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Introduction

This paper describes the author's application of Spatial Analysis and Forecasting to manage Type 2 Diabetes (T2D) conditions.

Method

The author utilizes the GH-Method: math-physical medicine to manage metabolic disorder diseases especially diabetes. Initially, he observed various disease phenomena. Therefore, he recorded big volume of related data, derived necessary and applicable mathematical equations, utilized suitable computational tools, including time-series analysis, spatial analysis, frequency domain analysis, and artificial intelligence. As a result, he combined them with the medical domain knowledge in order to forecast the forthcoming outcomes to interpret new findings or discoveries regarding human health.

In this paper, he disregards the theoretical discussion of spatial analysis in order to focus on application and certain results from his diabetes research by using spatial analysis and forecasting method.

Results

Here are some of the results from spatial analysis and forecasting:

- 1. Weight:** The orientation of data cloud with predicted and measured weight values are skewed from lower right toward upper left. The values of predicted weight and actual weight are very close to each other and move together simultaneously. This reflects high accuracy and correlation between these two variables.
- 2. Fasting Plasma Glucose (FPG) in Early Morning:** The orientation of data band of FPG vs. Weight is also from lower left toward upper right. This means that they are closely related and weight is the major formation factor of FPG.
- 3. Postprandial Plasma Glucose (PPG) at Two Hours after Fist-Bite of Meal:** The orientation of data band of carbs/sugar vs. PPG is from lower left toward upper right (positive) which means more carbs/sugar creates higher PPG. How-

ever, the orientation of data band of post-meal walking vs. PPG is from upper left toward lower right (negative) which means more walking steps brings down PPG.

4. Hemoglobin A1C or HbA1C (A1C): The medical community uses A1C as the measuring yardstick to determine the severity of the patients' diabetes conditions. There are no consistent conversion ratios available between glucose and A1C. Therefore, the author applied statistics tools (including time-series analysis, spatial analysis, and frequency-domain analysis) and engineering approximation modeling to build an effective A1C forecasting model. Using spatial analysis to compare predicted A1C and lab-tested A1C (quarterly data due to insurance constraints); he noticed that spatial analysis tool is not as effective as time-series analysis tool due to limited lab-tested A1C (only 23 data). One limitation about spatial analysis is the requirement of a larger size of data in order to see the trend of data change.

Conclusion

By using spatial analysis method, this clinical case study of more than four years, encompassing 1,488 days and ~500,000 big data, has demonstrated its powerful forecasting capability on weight, glucose, and diabetes control.

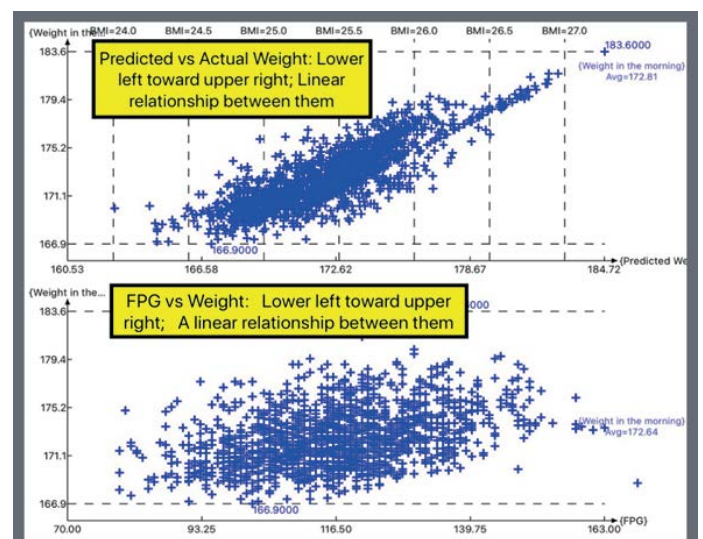


Figure 1. Weight and FPG

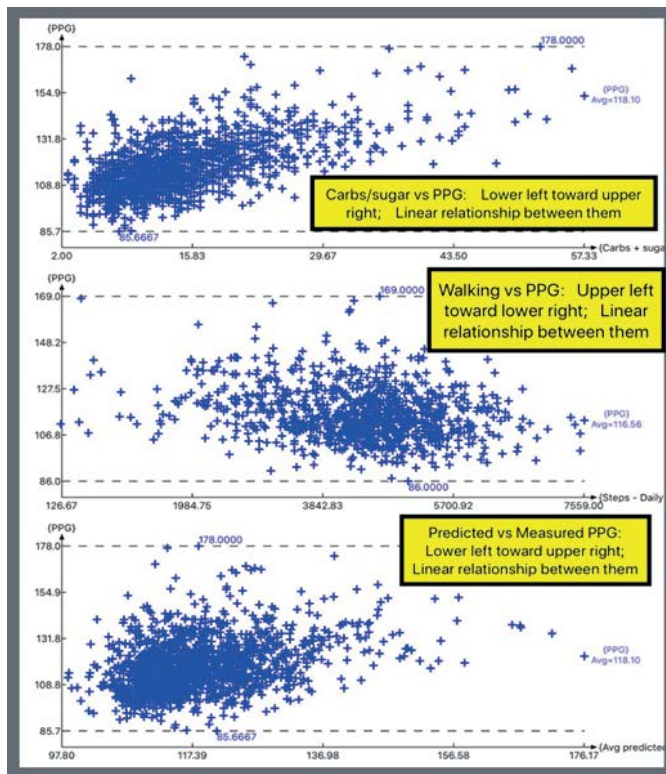


Figure 2. Carbs/sugar (+R) and Walking (-R) vs. PPG

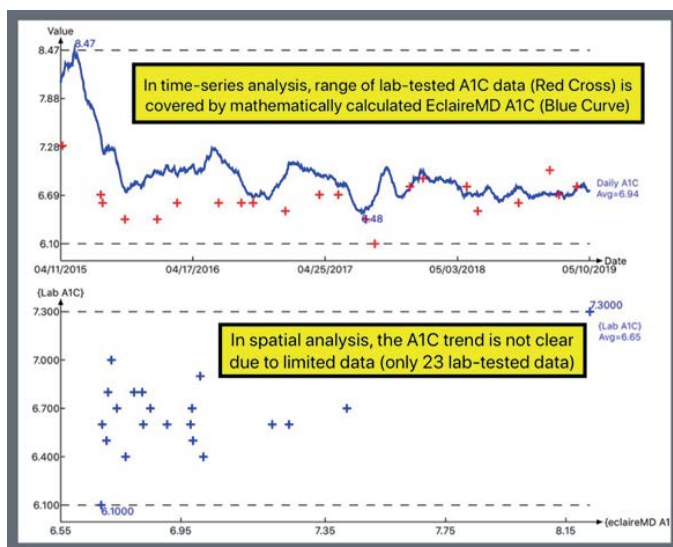


Figure 3. HbA1C

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