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Using signal processing techniques to predict PPG for T2D

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Background & Aim: The author has collected a complete set of PPG and lifestyle data for a period of 994 days with 2,982 meals (6/11/2015-3/1/2018). This paper discusses the methodology and accuracy of his developed PPG prediction model using signal processing techniques for type 2 diabetes.

Materials & Methods: Due to his academic background in mathematics, physics, and engineering, he views these biomedical and lifestyle data as a collection of nonlinear signal waves. He applied signal processing to decompose this time-series measured PPG signal into multiple (>10 lifestyle factors) single-sourced composite waveforms, examined each composite signal, and then recombined them into a predicted PPG curve. Finally, he compared this predicted signal against the measured signal to calculate its accuracy and correlation. He further improved his model via a trial-and-error "curve-fitting" method.

Results: The PPG's major creation source, corresponding glucose, and contribution level are as follows: Carbs/Sugar: 14.5 mg/dL, 37%; Post-meal Exercise-15.7 mg/dL, 41%; Weather 3.8 mg/dL, 10%; Measurement delay -2.4 mg/dL, 7% and Others -1.9 mg/dL, 5%. During this period, his average PPG values are: Predicted 119.16 mg/dL Measured 119.88 mg/dL with 99.4% linear accuracy and a high correlation of 70%.

Conclusion: The quantitative results from the developed PPG prediction model reflect the accuracy and applicability for type 2 diabetes control via a guided lifestyle management. The utilization of signal processing from electronics engineering and computer science is also proven quite effective for this investigation.

Biography

Gerald C Hsu has received his PhD in Mathematics and majored in Engineering at MIT. He has attended different universities over 17 years and studied seven academic disciplines. He has spent 20,000 hours in T2D research. First, he studied six metabolic diseases and food nutrition during 2010-2013, then conducted research during 2014-2018. His approach is "Math-Physics and Quantitative Medicine" based on mathematics, physics, engineering modeling, signal processing, computer science, big data analytics, statistics, machine learning, and AI. His main focus is on preventive medicine using prediction tools. He believes that the better the prediction, the more control you have.

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