Proceedings of the International Conference on Industrial Engineering and Operations Management
Monterrey, Mexico, November 3-5, 2021

Noninvasive detection of glucose levels using a commercial pulse oximeter and artificial intelligence

Luis Guzman, Antonio Martinez-Torteya and Andrés Garzafox
Universidad de Monterrey
Av. Morones Prieto, Monterrey, N.L. México
luis.guzman@udem.edu, antonio.torteya@udem.edu, andres.garzafox@udem.edu

Abstract

Type I and II diabetic patients must measure their glucose level from 2 to 10 times daily by invasive methods, the most used device is the glucometer. This device causes many problems to patients, such as discomfort, fear, pain, and a strong economic spending. Nowadays, there are non-invasive methods that can determine the glucose level, but they are unaffordable for most people. Detecting peaks on electrocardiograms (ECG) signals is indispensable to calculate heart rate variability (HRV), also, plethysmography can be used to determine HRV, but it requires a precisely algorithm without signal gaps. Other researchers have found a strong relationship and statistical correlation between HRV and glucose level, but only limited statistical methods with non-representative databases had been used to estimate this correlation. Regression and classification methods were used to determine the glycemic status of healthy patients; HRV was the main physiological variable used. Designed PPG and ECG peak detectors were 99% accurate, this quality was critical to calculate a precise HRV. Machine learning methods results were positive; the best classification method was random forests with an exactitude of 85% and best regression method was an assembly between SVR, Lasso and Elasticnet models with an RMSD of 18.6621 mg/dl.

Keywords
Electrocardiogram, plethysmography, heart rate variability, regression, classification.

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