

Continuous Glucose Monitoring: Real-Time Algorithms for Calibration, Filtering, and Alarms

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Abstract

Algorithms for real-time use in continuous glucose monitors are reviewed, including calibration, filtering of noisy signals, glucose predictions for hypoglycemic and hyperglycemic alarms, compensation for capillary blood glucose to sensor time lags, and fault detection for sensor degradation and dropouts. A tutorial on Kalman filtering for real-time estimation, prediction, and lag compensation is presented and demonstrated via simulation examples. A limited number of fault detection methods for signal degradation and dropout have been published, making that an important area for future work.

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Abbreviations: (ANN) artificial neural networks, (AR) autoregressive, (CGM) continuous glucose monitoring, (CGMS) continuous glucose monitoring system, (FD) finite differences, (FDA) Food and Drug Administration, (FIR) finite impulse response, (FSN-CGM) FreeStyle Navigator continuous glucose monitoring, (IIR) infinite impulse response, (SMBG) self-monitoring blood glucose

Keywords: alarms, algorithms, blood glucose, calibration, filtering, hypoglycemia, optimal estimation, prediction

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