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Blood glucose prediction based on sigma-model for closed-loop systems

Nikolai A Bazaev and Pozhar K V
National Research University of Electronic Technology, Russia

The aim of modern science in diabetes therapy is to develop a closed-loop system, which can compensate the disease effect. Such systems need a reliable algorithm that would be able to detect errors in its operation and compensate glucose monitors inaccuracy especially for non-invasive ones. The basis of this algorithm is mathematic model of BG regulation. Developed sigma-model assumes that glucose dynamics is strongly connected to regulation of insulin, epinephrine and glucagon. Ascents of BG are mainly caused by food intake, glucagon-caused gluconeogenesis and glycolysis and stress. Descents of BG are caused by bolus insulin injection. Background constant processes are epinephrine-caused gluconeogenesis as well as glycolysis and glycogenesis caused by residual and basal insulin. Form of ascend and descent is sigma function with magnitude and slope depending on the level of the causing factors (meal weight, bolus injection speed, stress level) and a number of parameters. Developed prediction algorithm is based on comparison between measured and predicted by the model BG. A 10% and 15% confidence interval are built around the model and measured data are analyzed depending on the hit in the corresponding interval. The algorithm is able to predict blood glucose level for 30 minutes, to calculate insulin dose, to detect portable non-invasive glucose meter errors, to notice glucose meter and insulin infusion system faults, to correct mathematic model input data. Prediction error is less than 10%.

Biography

Nikolai A Bazaev has completed his PhD and currently working as a Senior Scientist in National Research University of Electronic Technology, Department of Biomedical Systems. He has published more than 10 papers in reputed journals. He is an actual Member of ESAO since 2016 and Member of ERA-EDTA since 2017.

kir-p@rambler.ru

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