

Accepted Manuscript

Enhancing Automatic Closed-Loop Glucose Control in Type 1 Diabetes with an Adaptive Meal Bolus Calculator – In Silico Evaluation under Intra-Day Variability

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PII: S0169-2607(16)30729-5
DOI: [10.1016/j.cmpb.2017.05.010](https://doi.org/10.1016/j.cmpb.2017.05.010)
Reference: COMM 4425



To appear in: *Computer Methods and Programs in Biomedicine*

Received date: 18 July 2016
Revised date: 2 April 2017
Accepted date: 25 May 2017

Please cite this article as: Pau Herrero , Jorge Bondia , Oloruntoba Adewuyi , Peter Pesl , Mohamed El-Sharkawy , Monika Reddy , Chris Toumazou , Nick Oliver , Pantelis Georgiou , Enhancing Automatic Closed-Loop Glucose Control in Type 1 Diabetes with an Adaptive Meal Bolus Calculator – In Silico Evaluation under Intra-Day Variability, *Computer Methods and Programs in Biomedicine* (2017), doi: [10.1016/j.cmpb.2017.05.010](https://doi.org/10.1016/j.cmpb.2017.05.010)

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Highlights

- In this paper, we present a novel technique to automatically adjust the meal-priming bolus within an artificial pancreas. For this purpose, a Run-to-Run algorithm incorporating a new control law, which avoids some of the limitations of previously proposed techniques, is introduced. Then, Case-Based Reasoning, an artificial intelligence technique which solves new problems based on the solutions of similar past problems, is employed to account for intra-subject insulin sensitivity variability.
- To evaluate the proposed technique against a non-adaptive meal-priming bolus calculator, an *in silico* evaluation using a modified version of the latest FDA-accepted UVa-Padova Type 1 Diabetes Mellitus simulator. For this purpose, 11 adult and 11 adolescent virtual subjects under real-life conditions were employed. For evaluation purposes, a novel version of the clinically validated Imperial College Bio-inspired AP controller.
- A t-test statistical analysis showed that, compared to a non-adaptive bolus calculator within a closed-loop controller, the proposed method has the potential to significantly improve glycemic control in diabetes management.

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