

Double Action Personalized Advisory System for Type I Diabetes Patients for Improved Glycemic Control

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INTRODUCTION

ONE main problem for type I diabetes patients is the choice of the right dosage of insulin to prevent both hypo- and hyperglycemia. To this end, patients are given rules of thumbs which, to some extent, are tailored to their needs, but do not take in account the specific conditions. Against this background, an European project (DiadvisorTM [4]) aims at providing better tools for the patient to make the right choices. One part of the project is concerned with providing advice on the quantities to be used. Both control theory and practice show that having a wider control authority allows to obtain a better performance. In the case of diabetes, this means that the advisory system does not only provide suggestions concerning the insulin amount and time, but also on the intake of additional sugar to prevent hypoglycemia. The goal can be achieved by using a model predictive controller (MPC), which uses a linear insulin/glucose model of the patient [2], [3].

MATERIALS AND METHODS

As a part of the DiadvisorTM project, acquisition of clinical diabetes data was accomplished in a series of experiment sessions. During a 3-day in-hospital trial, 91 patients received 3 standard meals each day and used finger-prick measurements to decide the bolus insulin doses.

All important values like the time of the meals, the amount of carbohydrates and the administrated insulin doses were registered in a logbook. The recordings were complemented by continuous blood glucose monitoring. Here, a representative patient was selected to evaluate the developed algorithms.

A MPC calculates for a finite horizon in the future a series of input values for a system to minimize the predicted error. To be able to predict the future values of a system or a patient it is necessary to have an individual model. For this the data collected during the clinical trial is used to parameterize the model of the blood glucose of the specific patient and so to personalize the controller. In operating mode the MPC needs the past and actual measurements of

the blood glucose and a reference. As a result the controller creates advices for the patient, see Fig. 1.

RESULTS

The advisory system was evaluated in-silico. The suggested insulin from the MPC can be verified against the insulin suggestions from the physician. Additionally the MPC suggests some carbohydrate intakes whenever the patient is in danger to have too low glucose concentrations.

The study shows that the advices given by the MPC are useful for the patient and can help him to decide which

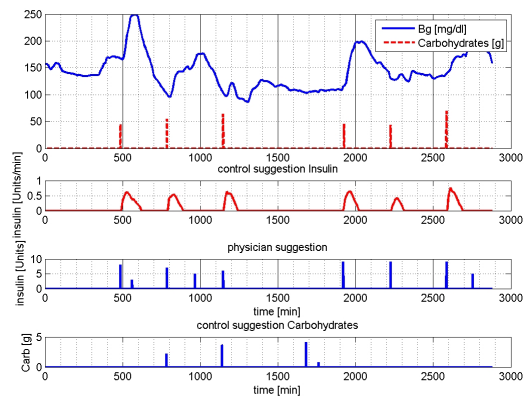


Fig. 1. MPC advices vs. physician suggestions

actually the right dosage is and decrease the fear of hypo- and hyperglycemia as consequence of a wrong decision.

OUTLOOK

In the next months it is expected that the developed algorithms are implemented and tested on real patients during a clinical trial within the scope of [4].

REFERENCES

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