Accuracy Analysis of an Autonomous System to Personalize Blood Glucose Prediction for T1DM Patients with Real World Data

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Objective:
BGL predictive algorithms can improve T1DM treatment preventing glucose excursions. An autonomous system based on neural networks was developed to personalize blood glucose predictions based on blood glucose, insulin infusion, nutrient intake and heart rate in real world scenario's.

Method:
20 T1DM patients were monitored with flash glucose monitors, activity trackers and a mobile app (GlucoTrends) to collect meal and insulin data. Personalized prediction models were trained independently, without requiring specific settings for each individual. Patient's characteristics: 11 males and 9 females, age: 32.4 (SD:10.5), BMI: 26.0 (SD:3.8), BGL: 159.1 (SD:34.0), under the following therapies: 45% under fixed doses, 40% carbohydrate counting and 15% insulin pumps. Patients were monitored during on average 29.3 days (SD: 7.9), and the last 20% of measurements were reserved for evaluation. Prediction accuracy for 1-hour prediction horizon was evaluated by Clarke Error Grid (CEG) compareding to BGL measured with flash monitor.

Result:
The percentage of predictions within AB zones of CEG for all-day and for night-time only periods are 92.9% and 94.0%, respectively (Figures 1 & 2). Patients using Insulin Pumps (Analog insulin), Fixed Doses (Human insulin) and CArbohydrate counting (Analog insulin) had 97.5% (SD:0.7), 93.6% (SD:4.5) and 90.0% (SD:8.2) predictions within AB zone on average, respectively (Figure 3).

Conclusion: Our proposed algorithm has demonstrated to be capable to personalize glucose prediction in a real world scenario and poses as a potential solution for an autonomous support system. In our study different insulin regimen and molecules confirmed expected results. Potential issues relative to higher than desired predictions in zone D may be caused by sensor's error biases within minimum glucose levels, patient data entry of carbs and other sources.