

# USING A CAUSAL SMOOTHING TO IMPROVE THE PERFORMANCE OF AN ON-LINE NEURAL NETWORK GLUCOSE PREDICTION ALGORITHM

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**Aims:** This work evaluates a spline-based smoothing method applied to the output of a glucose predictor. **Methods:** Our on-line prediction algorithm is based on a neural network model (NNM). We trained/validated the NNM with a prediction horizon of 30 minutes using 39/54 profiles of patients monitored with the Guardian<sup>®</sup> Real-Time continuous glucose monitoring system. The NNM output is smoothed by fitting a causal cubic spline. The assessment parameters are the error (RMSE), mean delay (MD) and the high-frequency noise (HFCrms). The HFCrms is the root-mean-square values of the high-frequency components isolated with a zero-delay non-causal filter. HFCrms is  $2.90 \pm 1.37$  (mg/dl) for the original profiles.

**Results:** Figure 1 depicts the original sensor profile, the NNM prediction without smoothing (P0), and with two different smoothness parameter values (P1-a:low-smoothing,P1-b:high-smoothing). Table 1 shows the evaluation parameters.

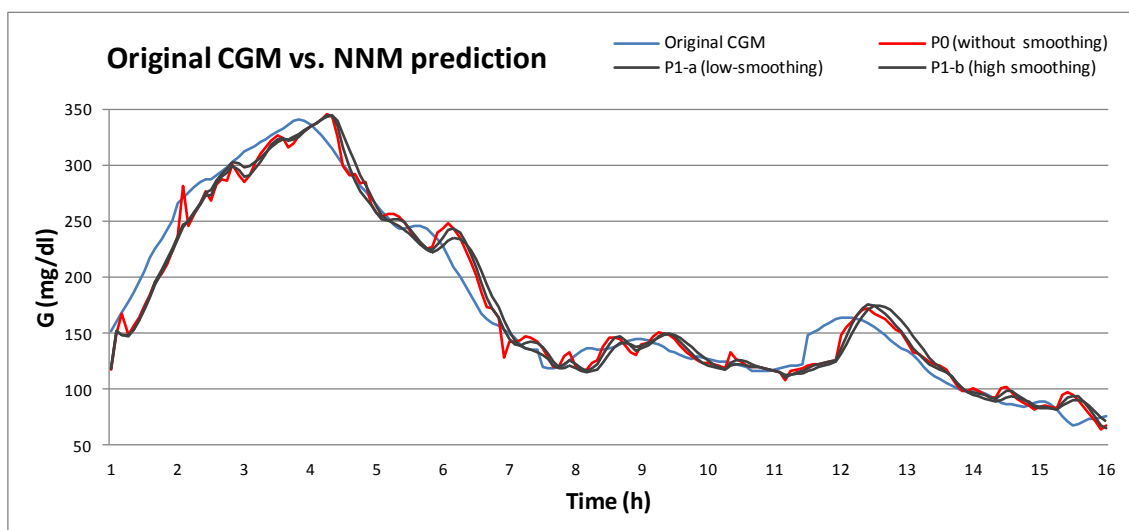


Figure 1

		<b>P0</b>	<b>P1-a</b>	<b>P1-b</b>
RMSE(mg/dl)		$16.99 \pm 6.76$	$17.9 \pm 7.05$	$18.97 \pm 7.55$
MD(minutes)	Upward	$10.78 \pm 7.05$	$11.7 \pm 7.69$	$12.63 \pm 8.88$
	Downward	$7.86 \pm 5.28$	$8.22 \pm 5.48$	$9.69 \pm 6.16$
HFCrms(mg/dl)		$6.80 \pm 2.60$	$4.41 \pm 1.78$	$2.83 \pm 1.21$

Table 1

**Conclusions:** Smoothing the NNM output provided a more stable (less noisy) prediction profile, what is useful to discard prediction artifacts; hence allowing safer corrective actions by the patient or by a closed-loop controller. Therefore, we suggest the HFCrms as an additional evaluation parameter to assess the performance of prediction algorithms.