**Meeting 16/02/2021 + Meeting 17/02/2021**

Notes 16/02/2016

Device setup from the slides is correct.

Thomas suggests to interpolate historical glucose data (so that it looks a bit like the actual glucose values of scan or bubble).

It’s mostly important to predict the glucose in the future. The historic glucose is good enough for that. They want to know how what they’re doing now will affect their future glucose values.

There’s some issue with the resampling I think, TODO: maybe change that

Mathias: don’t use the shifted features but just use the summary statistics as input of the model.

Maybe HRV is not the best to use for now. Martin Maritsch is working on it, we should contact them if we want HRV from devices.

Correlation plot is interesting, but now of course only at the same timestep without delay. IDEA: maybe do sth with shifting the timesteps and cross-correlation.

Thomas will send how to calculate HbA1c

Questions

Can I assume that after the first time the athletes started using Libre, they also started using Bubble and did not use Dexcom anymore at all?

*Yes, there is a “hard” cut-off between Libre and Dexcom. So once they started using Libre, all data in the training-peaks file is from the Bubble device.*

How variable is the data within one minute?

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What is the delay between the subcutaneous glucose and blood glucose?

How fast does it take before changes in the blood glucose happen after doing a lot of exercise?

*There is a two-step delay. One is a physiological delay (so the delay between exercise and changes in the blood glucose), and the other one is a “technical” delay (so delay between blood glucose and subcutaneous/interstitial glucose). For the technical (or physiological??) delay, Fede estimates 7-15 minutes. However, blood flow is a big factor here. If the blood flow is stable, there can be no delay. During exercise there are big changes in the blood flow, so this might also influence the delay.*

Can I use imputation of missing values in variables?

*Mathias: maybe you don’t even need to do this with a future model*

Would it be possible to acquire heart rate variability (r-r interval)?

<https://help.elitehrv.com/article/194-wahoo-tickr-issues>

Sends a signal over bluetooth (not ANT+), Elite HRV is the app that can read it

<https://www.trainingpeaks.com/blog/how-to-track-your-heart-rate-variability-using-trainingpeaks/>

*For now we don’t have it, but maybe something for in the future. It is also the question whether it actually tells something additional about the glucose, because heart rate variability is dependent on exercise anyway. Sam thinks it will be too noisy.*

What happens during training? How many times insulin? How many times food? Do they pause the devices? Do they stop cycling?

*Both insulin and carbohydrates are not tracked. Insulin rarely happens. Carbohydrates, every 15 min they try to eat something, but they don’t know whether they do, that is up to the drivers, and when they do you don’t know how many calories, and also, they might be drinking something continuously with carbohydrates in it. Also, manually pressing start and stop is not going to help, because when they are doing interval trainings they are also pressing a lot of buttons.*

Are static variables such as body weight or HbA1c relevant for glucose prediction?

*Could be, Fede will send files where body weight, fitness level, VOmax, HbA1c are tracked throughout the season.*

Check: does Bubble simulate a scan?

*Yes*

How different are the glucose measurements of Dexcom compared to those of Libre?

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Which timerange is associated with the historic glucose? If historic glucose is in the excel file at time t, is it then the average of {t-15, t} or rather {t-7.5, t+7.5}?

*It’s always backwards. Sam said there might be a delay in it. TODO: good to double check before using this definitely.*

Are there duplicate timestamps because several devices are used at the same time?

*The cause of the duplicate timestamps are not entirely clear but they’ve also seen it that one device records multiple trainings in trainingpeaks. They don’t know what it’s caused by and whether it could be due to some manual issues with the drivers.*

Is it good to only select one device for now?

*Yes, ELEMNT BOLT/ROAM and Zwift are the right devices*

Notes 17/02/2016

Glycaemic control changes over the season. Also during the season there is an accumulation of impact on the body

* TODO: take it into account with train-test split?
* Use glycaemic control/season as a variable?

TODO: Use elevation gain instead of altitude as a feature. They also don’t know why there’s sometimes no ascent in there, but ascent should also be the difference in altitude.

Distribution of glucose is interesting by itself and for them already worthy of a paper by itself

It’s interesting for them to see how often someone is in hypo, and if this also happens after training or at night-time

* TODO: Stratify by time during training and outside of training (4h after training, night-time). There are 14 interesting points in time, Sam will send a paper about this.
* TODO: Stratify by athlete, to see if positive skew-ness is driven by specific athletes

TODO: Heatmap with glycaemic control (H1c..) over the course of a season for each athlete

IDEA: Somehow visualize how many times to hypo and how long in hypo - I don’t know yet how to do this

Rate of change in the model is interesting for them.

The dexcom device always gives you a prediction with an arrow that also has some sort of quantity. They don’t know how they calculate it, that’s up to the device itself, so there is no comparison but it would be interesting to see how much better using exercise data would make this prediction. Including exercise variables should make it more accurate.

TODO: we could make a prediction with and without exercise variables

Predict the rate of change in the future 15 min and 30 min in the future

In general it is interesting for them to “find patterns in the data” - (what they mean here is interpretability, e.g. which variables lead to a certain increase/decrease in blood glucose).

Fede: Whether a particular rider is consistently responding to a change in intensity. And also: what’s the effect of a training load on the next day glucose control

-> they like explainability

Decide to use dexcom data of 2019, because

* They have used it for research before
* They have the file easily
* They have the patient consent forms for 2019 data

The glucose in there is the 5 min average. There is no data from carbohydrates and insulin.

I also asked if there are additional (static) variables that could influence blood glucose. They will send data where they track body weight, glycaemic control, vo2max, etc throughout the season.

TODO:

* Fede sends data with bodyweight and fitness level, as well as dexcom data 2019
* Sam sends paper with stages after training
* Sam and Fede send which patients I’m allowed to use
* Fede sends paper with physiological delay
* Eva sends updates