

Cycling Analytics

Meeting 16 Feb 2021



Purpose

- Update progress
- Define objective of project

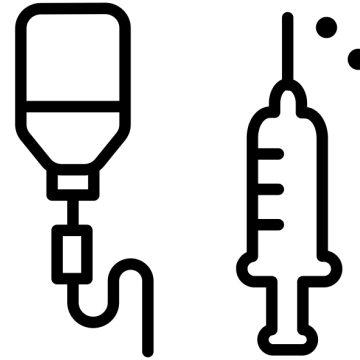
Data

Overview

Cycling



Glucose



Devices

Cycling



heart rate

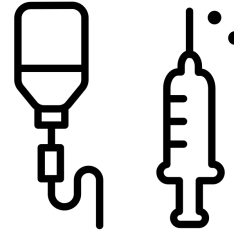


power



bike computer

Glucose



dexcom

----- june 2020



libre

Platforms

Cycling



heart rate



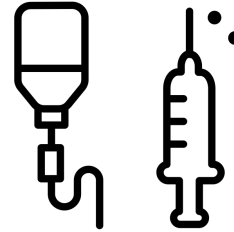
power



bike computer

TrainingPeaks (sec)

Glucose



dexcom

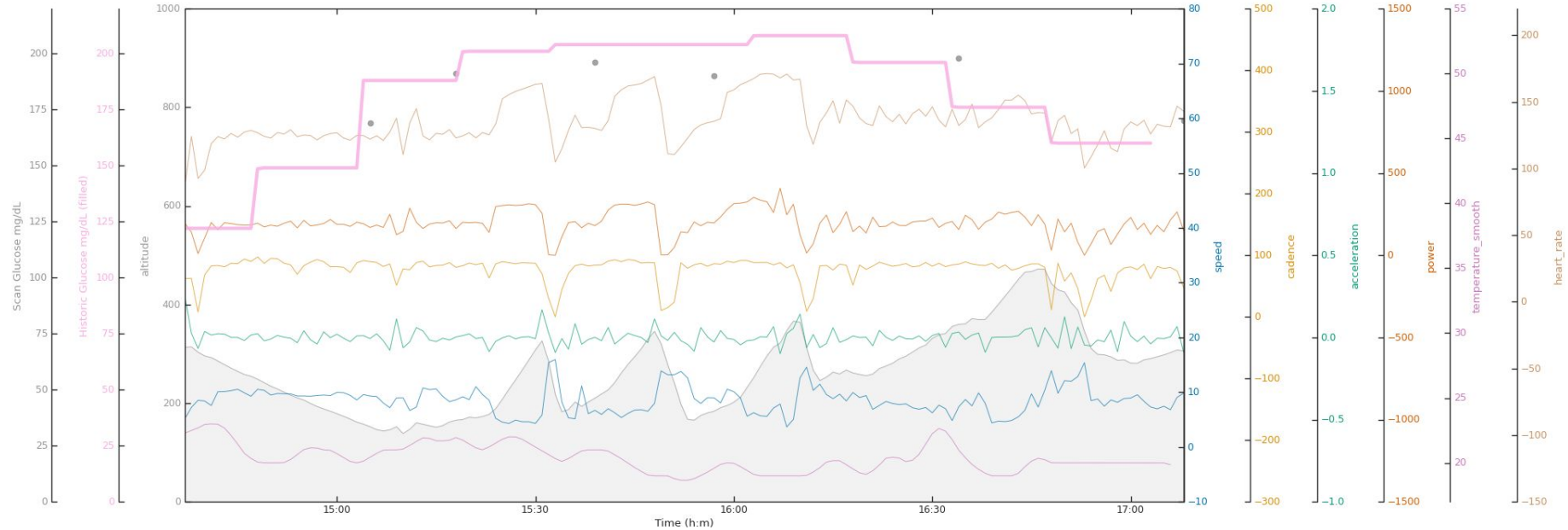
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libre

LibreView (min)

Example training session (with preprocessed data)



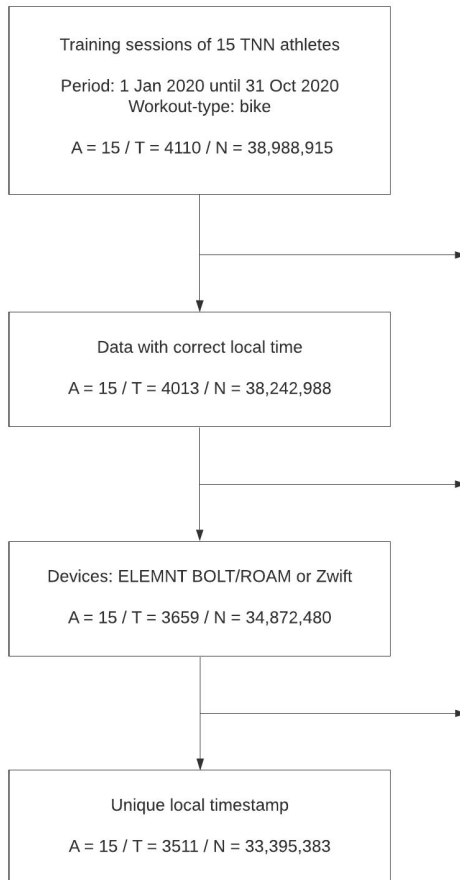
Cohort selection

Start

Remove data with
unknown/incorrect timezone

Select devices

Remove duplicate training sessions



15 athletes
4110 training sessions
38,988,915 samples

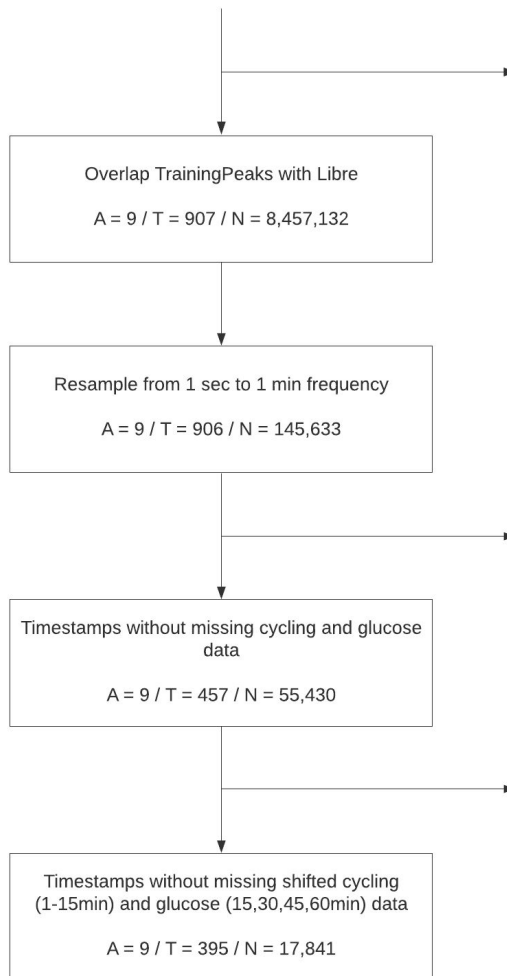
Cohort selection

Merge trainingpeaks with libre data

Resample from 1 sec to 1 min

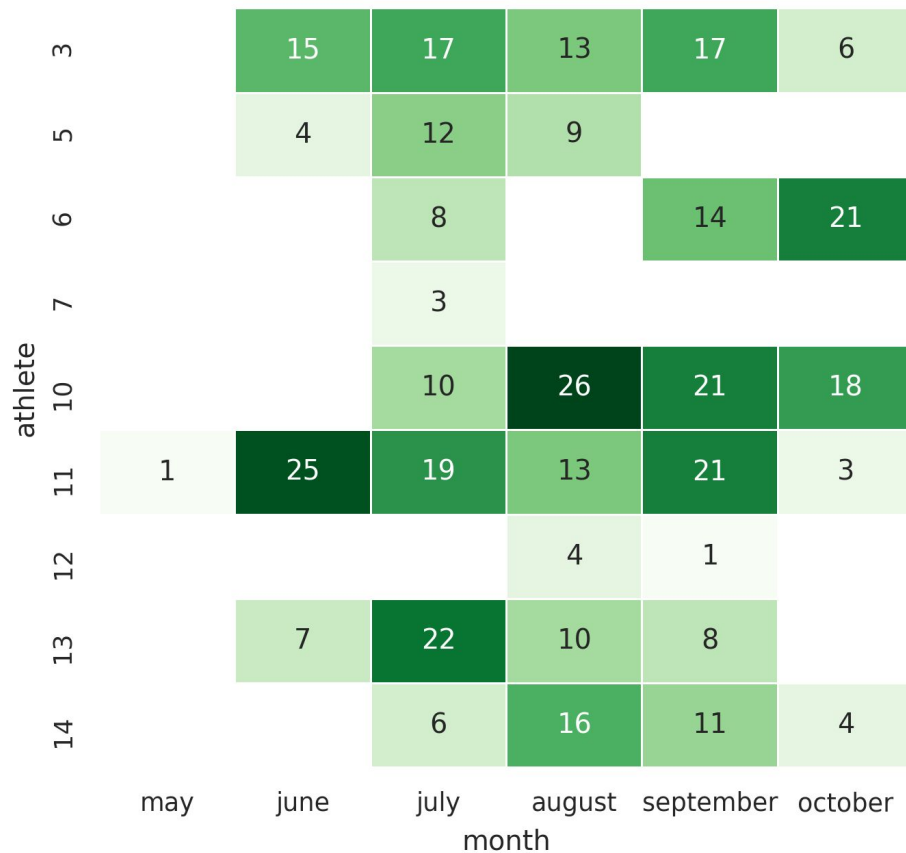
Remove missing data of features

Remove missing data of shifted
features

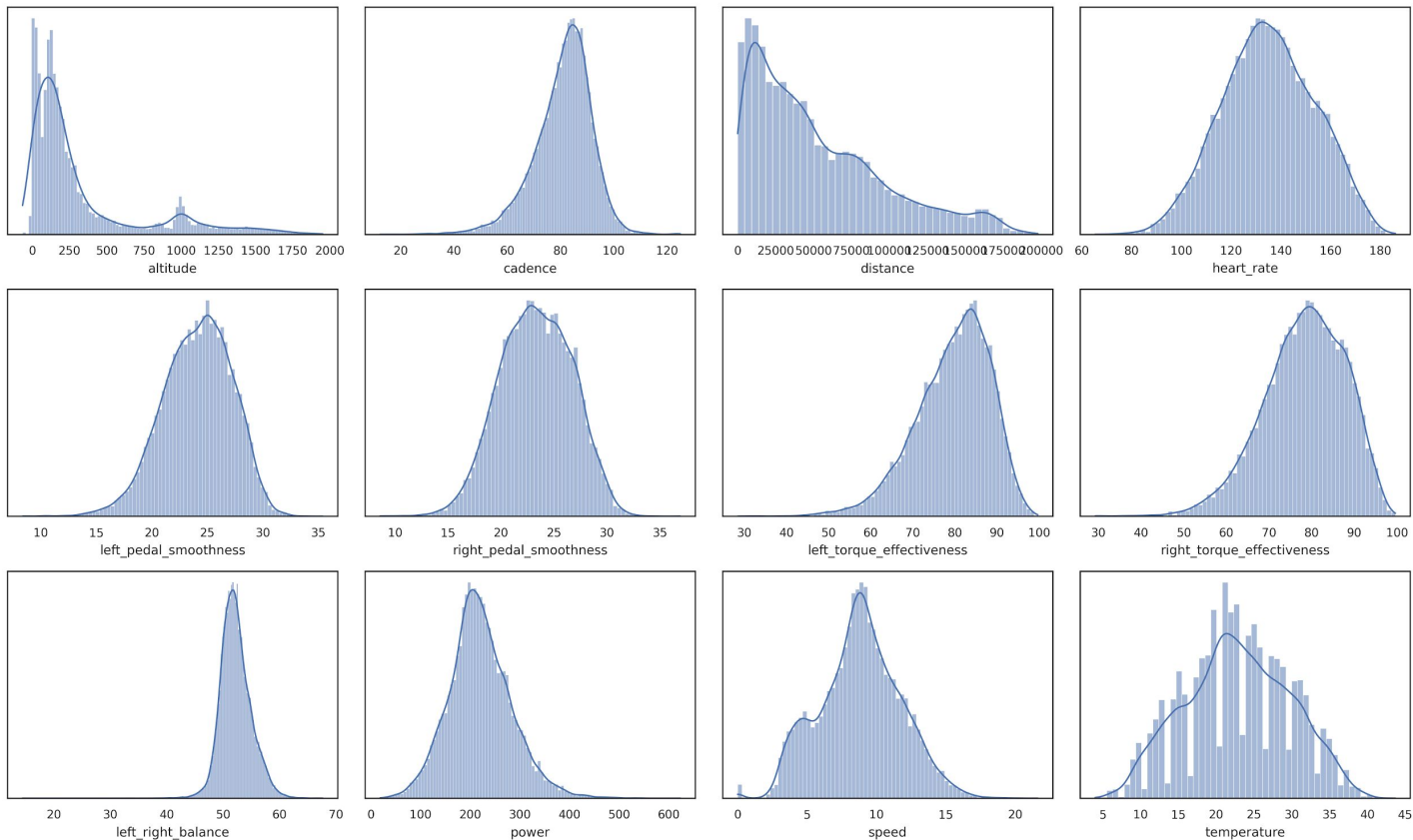


9 athletes
395 training sessions
17,841 samples

Calendar training sessions

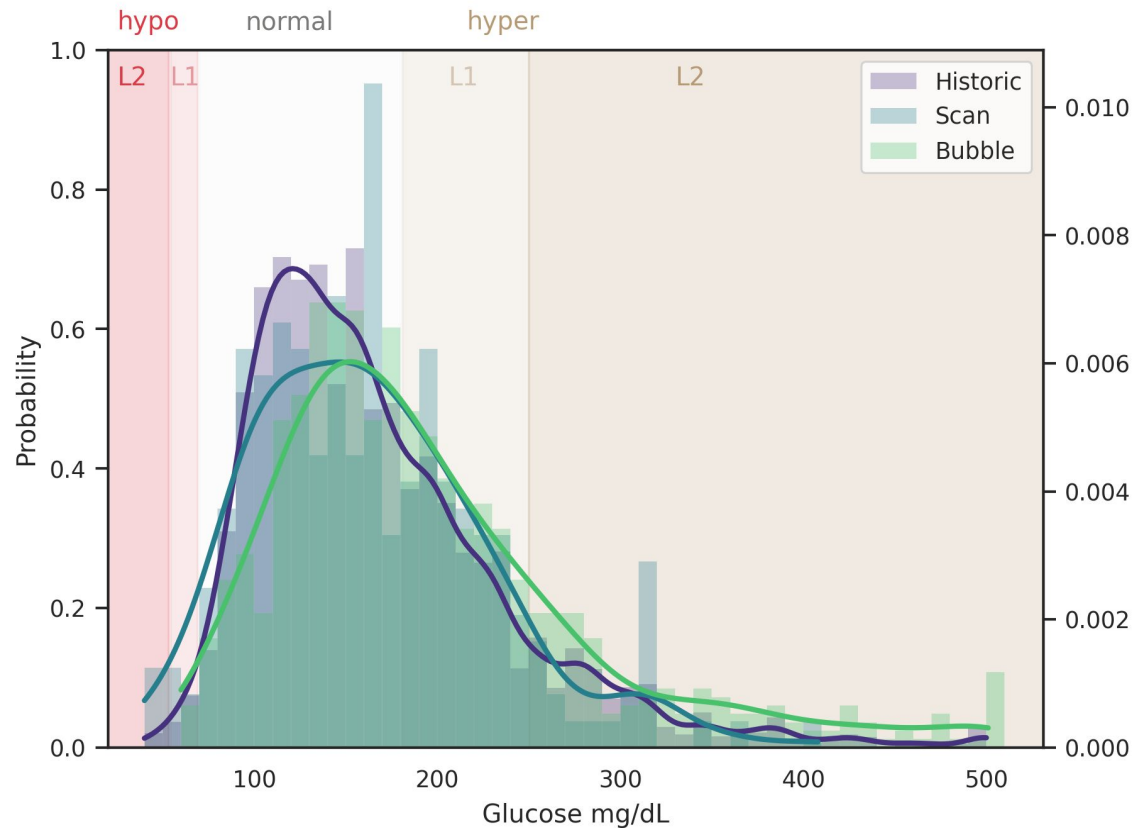


TrainingPeaks



Libre

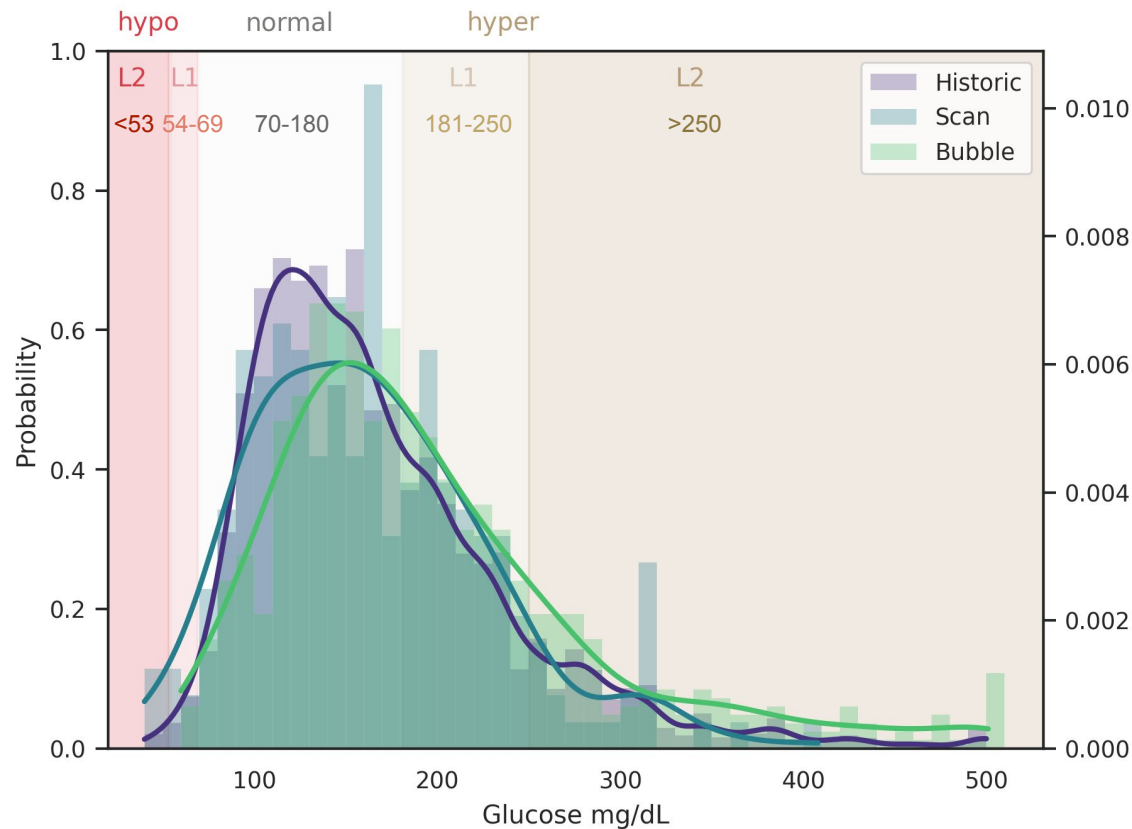
Scan at request
Historic 15 min average
Bubble imitates scan every 5 min



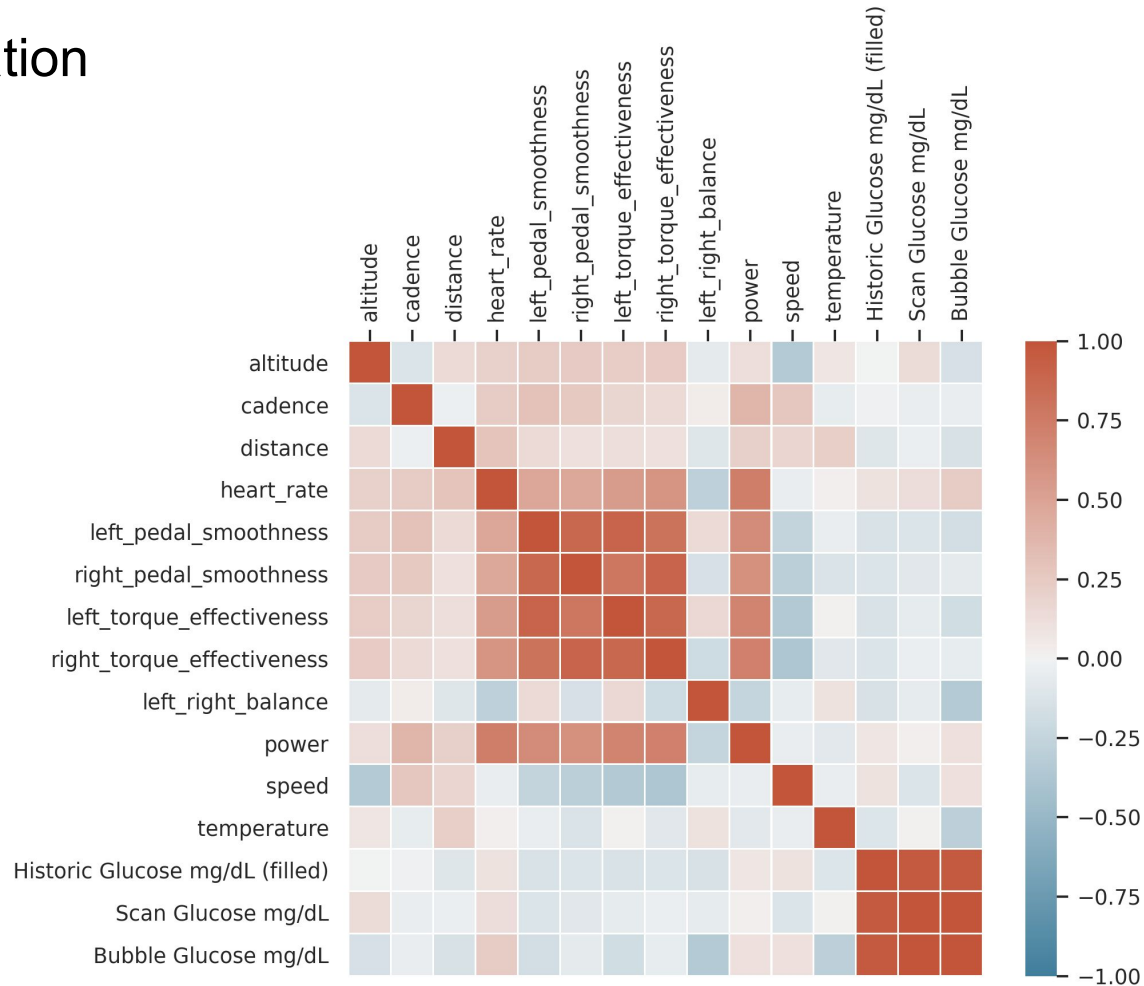
Libre

Scan at request
Historic 15 min *average*
Bubble imitates scan
every 5 min

Hypo in 0.7 to 3.5%
of measurements

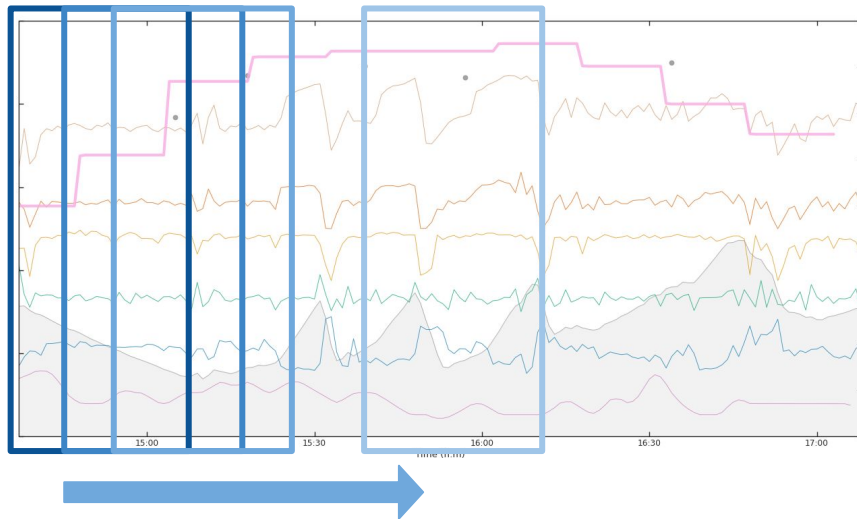


Correlation



Feature engineering

- Add features: e.g. acceleration
- **Sliding window approach**: get historic information of features
 - Feature x_i at different timesteps
 $x_i(t), \dots, x_i(t - 15)$
 - Summary information over time period
sum, mean, std, iqr, etc.
- Heart rate variability?



Objective

Use machine learning to support patients with Type 1 Diabetes in glucose management

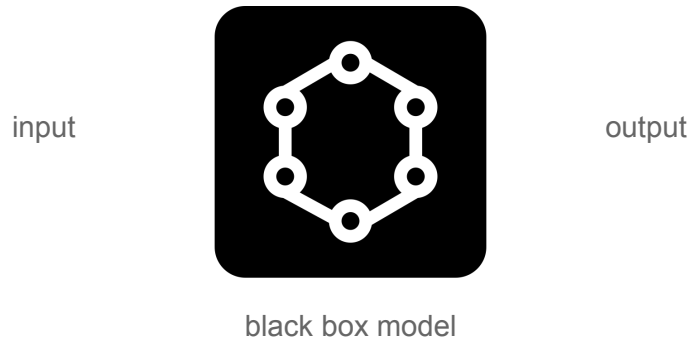
Use machine learning to support patients with Type 1 Diabetes in glucose management

In which way?

Machine Learning

Use *large quantities* of (complex) data to find patterns/relations that more traditional statistical methods cannot find

Can model *interactions* between variables



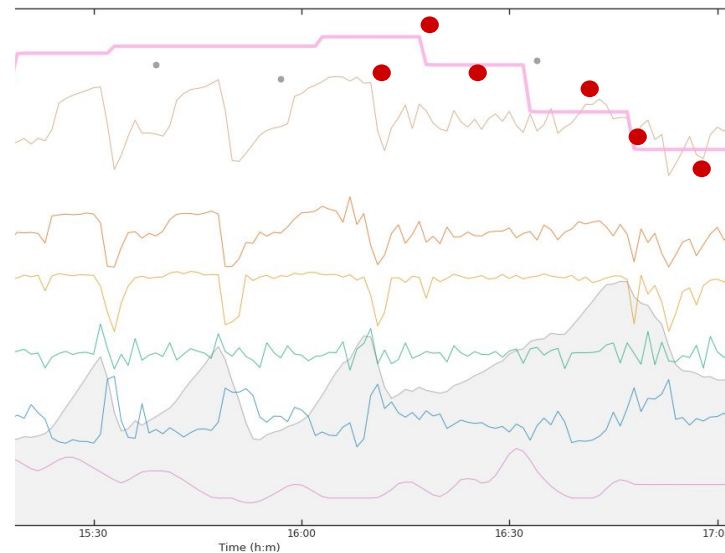
Transfer Learning: use data from one model as information for another model

Example: model dexcom glucose data and use it for a model of libre glucose data

Possible prediction tasks

What is relevant?

- Predicting glucose levels at shorter intervals (every minute)?
- Predicting risk of hypoglycemia?
- Insight in real-time glycaemic response (which variables increase/decrease glucose levels)?
- .. different prediction task ?



Model

INPUT

Cycling variables of the last 15 (?) min

$$x_0(t), \dots, x_0(t - 15), \dots$$

$$x_M(t), \dots, x_M(t - 15), \dots$$

Summary statistics of cycling variables of the last 30 (?) min

$$\sum_s x_0(t - s), \dots$$

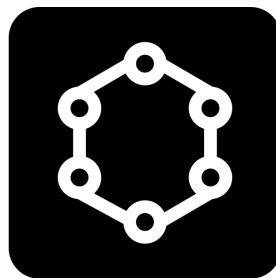
$$\sum_s x_M(t - s), \dots$$

Static variables (e.g. body weight)

$$x_{M+1}, \dots, x_K$$

Past glucose values

$$y(t - 5), y(t - 10), y(t - 15), y(t - 30), y(t - 45)$$



black box model

OUTPUT

Subcutaneous glucose at current time

$$y(t)$$

OR

Subcutaneous glucose in the future

$$y(t + 15)$$