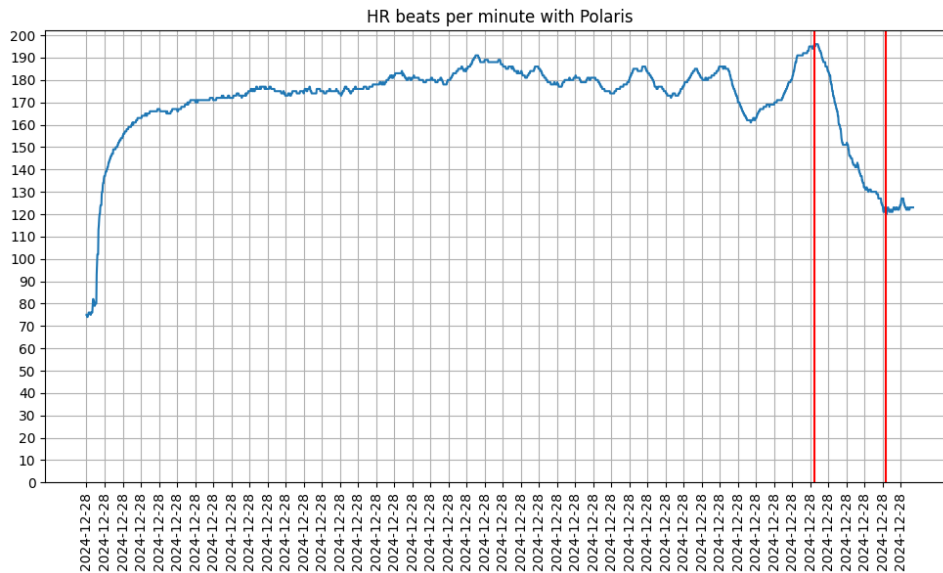


Recovery analysis

28/12/2024

In this notebook we are analyzing the recovery time between maximal attained hearth rate during training session and immediate running relaxation. This corresponds to the finishing time situation where the athlete achieves his maximal attained performance at the race finish and after the end of the race follows immediate **relaxation**. Assumption is that the athlete had pushed himself close to his subjective maximum and after that quickly transitioned himself to the relaxation state. After the relaxation state we have *stretching*.



In this figure we can see the timestamps where we achieved maximal and minimal HR bpm.

Here are the exact quantitative data for the following time series:

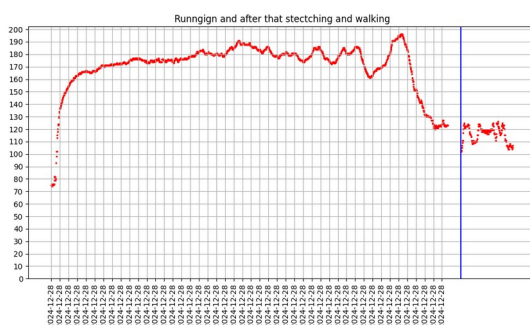
- Maximal hearth bpm: 196 @ 10:40:57
- Minimal hearth bpm: 120 @ 10:44:15
- Delta hbpm = 76 beats per minute
- Delta time = 198 sec = 3.3 min

Measures which can be extracted from this two arguments are hearth recovery delta and time recovery delta. Their ratio gives us the **recovery speed** of the body:

$$\text{recovery speed} = [\max(\text{hbm}) - \min(\text{hbm})] / [\text{argmin}(\text{hbm}) - \text{argmax}(\text{hbm})]$$

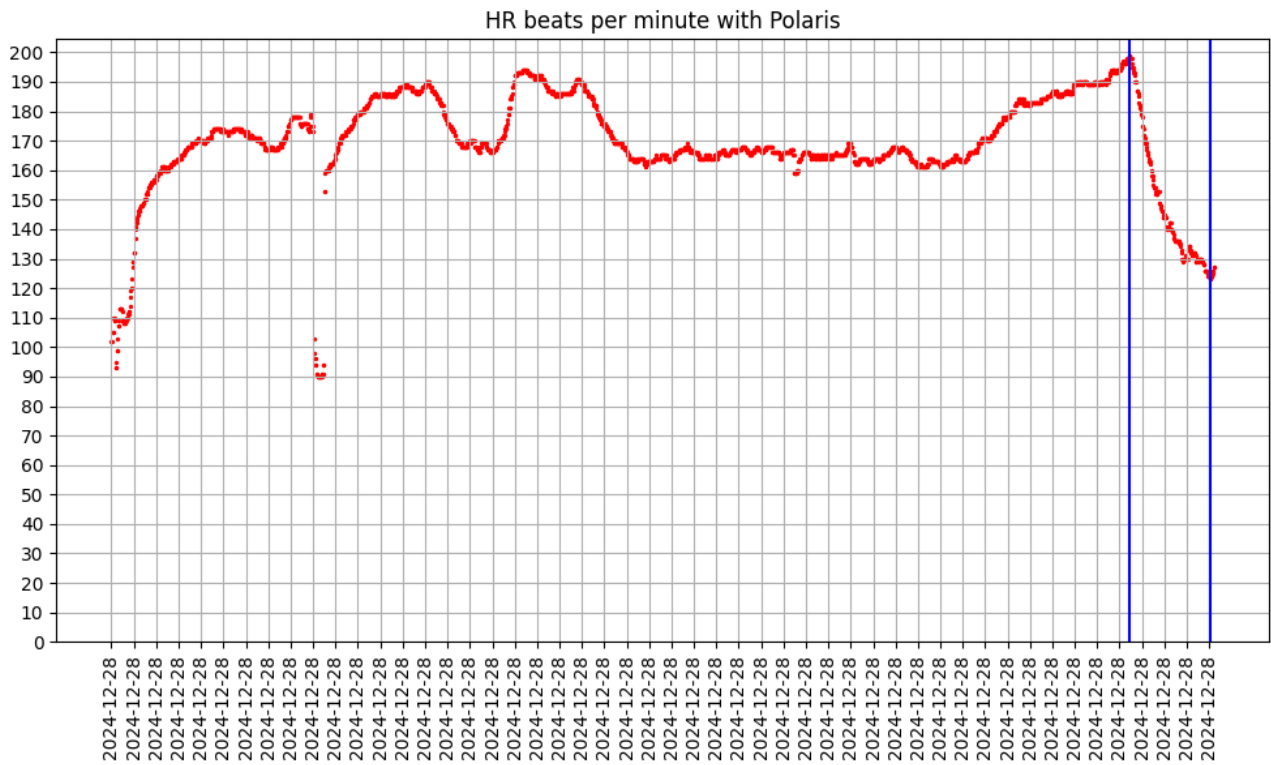
where the hbm is first future looking value from perspective of the curve maximal point.

In our case we have maximal recovery speed of : $\frac{76 \text{ beats}}{3.3 \text{ min}^2} = 23.03 \frac{\text{beats}}{\text{min}^2}$

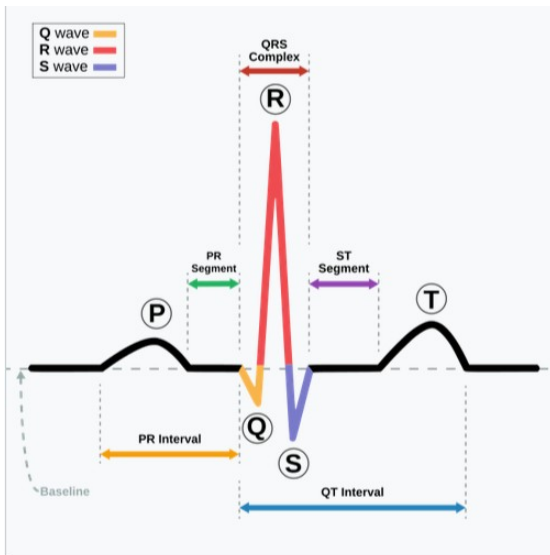


After the blue line we can see the random ~5 min stretching period with the combination of walking, deep breathing and stretching. This period is used as the reference which describes the state where human body goes after near maximal achievement

Downhill analysis



Definitions



One heart beat has following phases and points on the EKG diagram. A polar device detects QRS period with 95% precision. It means that it will “catch” around 95 QRS-es in

Reported bpm actually has forward looking bias. Device has a spring coil and

In our dataset we have pair timestamp and beats per minute = bpm. We assume this corresponds to the fixed estimation of the number of beats in the next minute. This assumption is of course wrong because packets have variable length and they follow some non-uniform distribution.