Outlier Detection with Neural Networks

RR intervals

measure heart rate series in a relaxed state [1]

plan and execute training session [1]

correct measuring errors / outliers

calculate heart rate variability values [1]
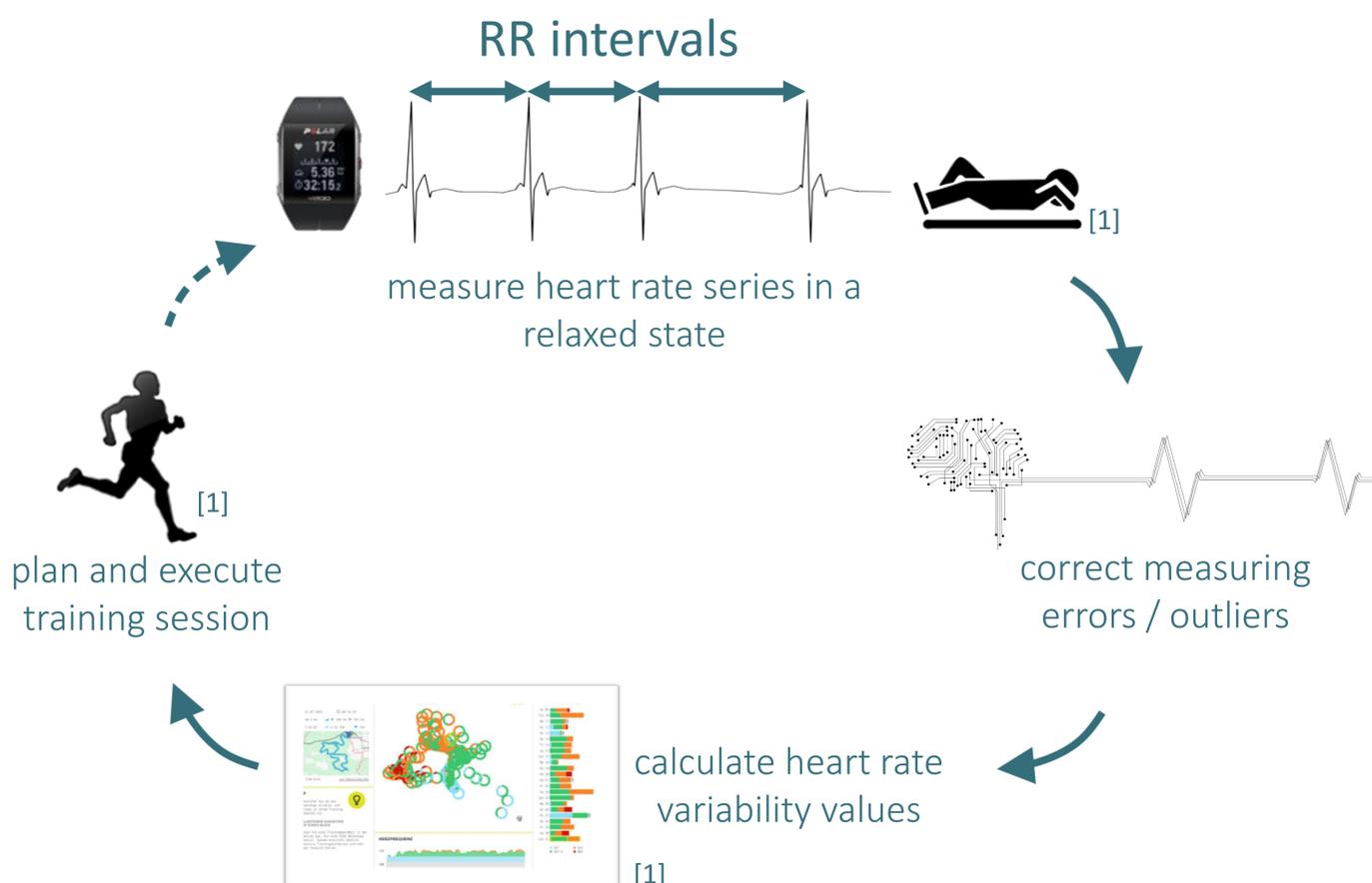
Long Short Term Memory (LSTM)

[1]
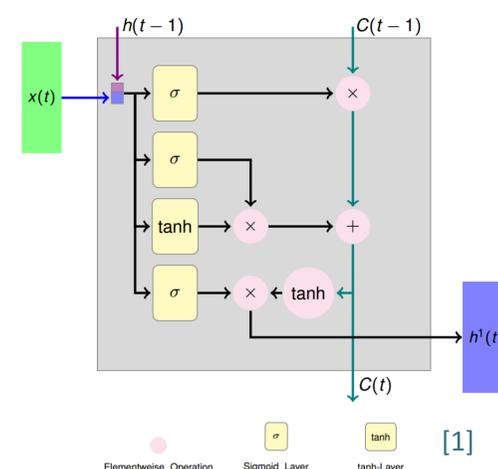
An LSTM is a special architecture of a recurrent neural network. With its gates it overcomes the vanishing gradient problem. We used it to predict RR intervals in measurement series out of its predecessors.

With help of the predictions we can correct outliers and improve the robustness of heart rate variability values which are used to estimate physical stress and fitness of a user.
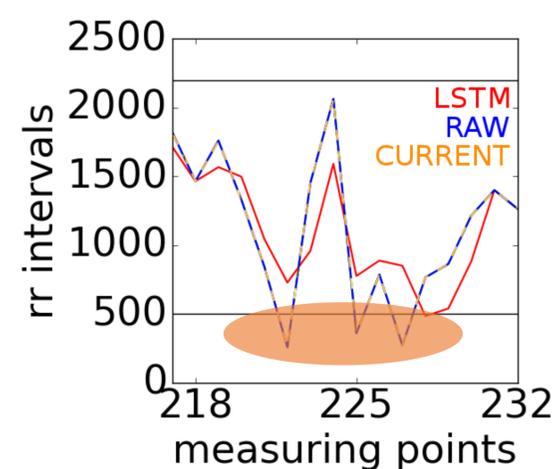
Results
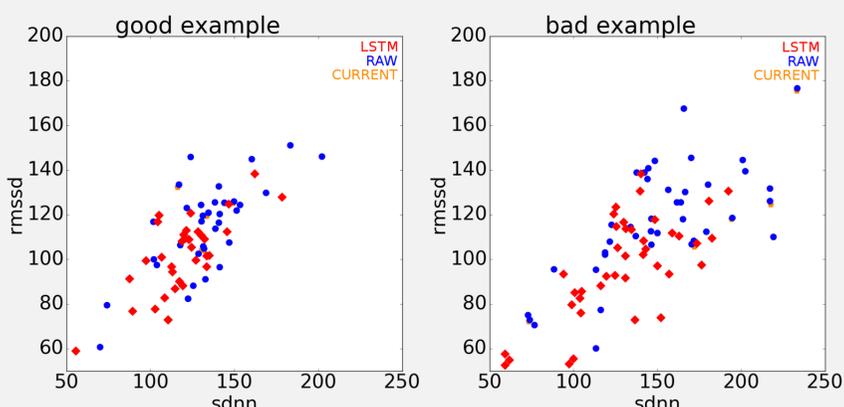
We labeled series with good and bad labels. Bad labeled examples supposed to have outliers.

We calculated the heart rate variability (HRV) values for each example and **filter** type: No filter (raw), current filter (threshold mean distance in an area around the measuring point), LSTM.

- Bad examples get shifted to smaller values
- Good examples get less adjusted

HRV Parameter	Current		Raw	LSTM	
	mean	diff	mean	mean	diff
sdnn (good)	151.19	- 0.02 %	151.22	129.47	- 14.39 %
rmssd (good)	117.34	- 0.17 %	117.54	97.08	- 17.41 %
sdnn (bad)	137.98	- 0.16 %	138.21	122.96	- 11.03 %
rmssd (bad)	122.10	- 0.35 %	122.53	109.82	- 10.38 %

[1] image source: Johannes Maucher