Usages of contrastive losses, Introduction and Applications

for sensor data

Halil Beglerovic & Jörg Simon, 30.April 2020

About me

- PhD on using DeepLearning to detect Human Factors from BioSignals
- Prof. Eduardo Veas and Herbert Danzinger
- Sometimes very Sparse Data!
- Bring fractioned Data Sets together with contrastive loss

Agenda

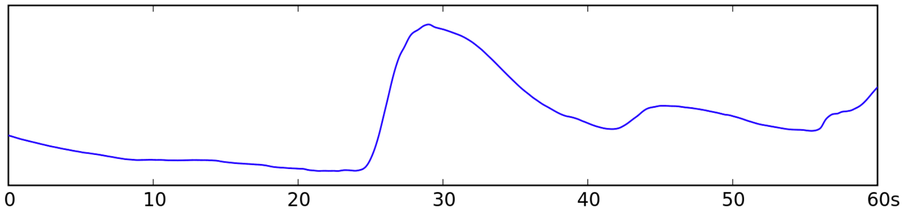
- History and other Terms for the same
- Fractioned Datasets of Drowsiness
- Unifying Sensor-Recordings for later Supervised Training
  - Demo & Code
- Summary

History and other Terms for the same

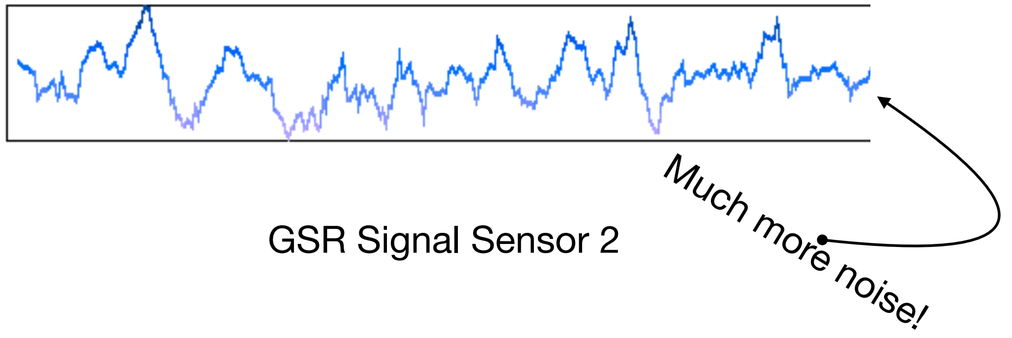
- First named that way in Person Identification
  - Siamese Networks
  - Different Loss Term
- Triplet Loss
- Metric Learning
- XNth Loss w. Hinton

Fractioned Datasets of Drowsiness

- We have a unit generating a signal
  - Unit: f.e. a **driver** of a car
  - Signal: **Physiological Signals** for modes (alert, normal, drowsy, asleep)
  - We have data from 4 experiments, but they all used **slightly different sensors** of the same type (EEG, ECG, GSR)



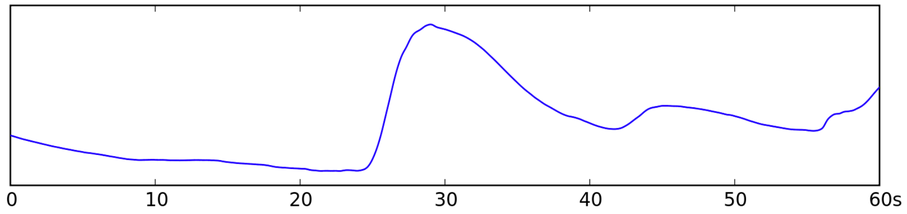
GSR Signal Sensor 1



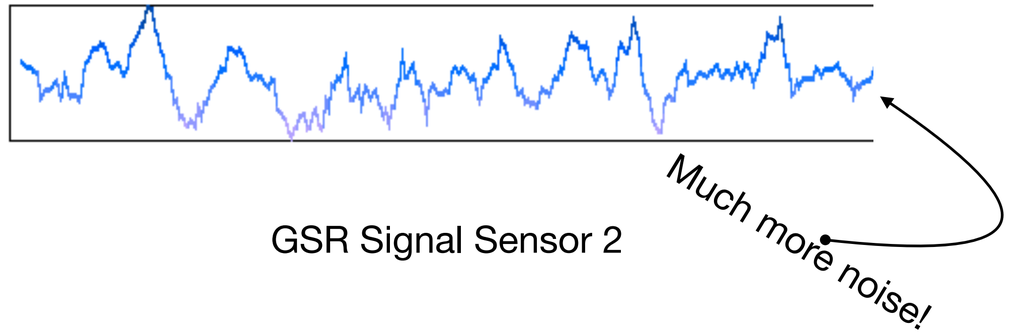
GSR Signal Sensor 2

Fractioned Datasets of Drowsiness

- Contrastive Loss:
  - Use all Data
  - Transform Data into Embedding where differences of sensors are mitigated
- Fine-Tune Classifier on that



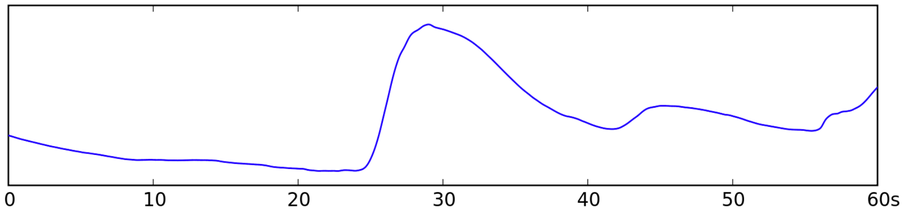
GSR Signal Sensor 1



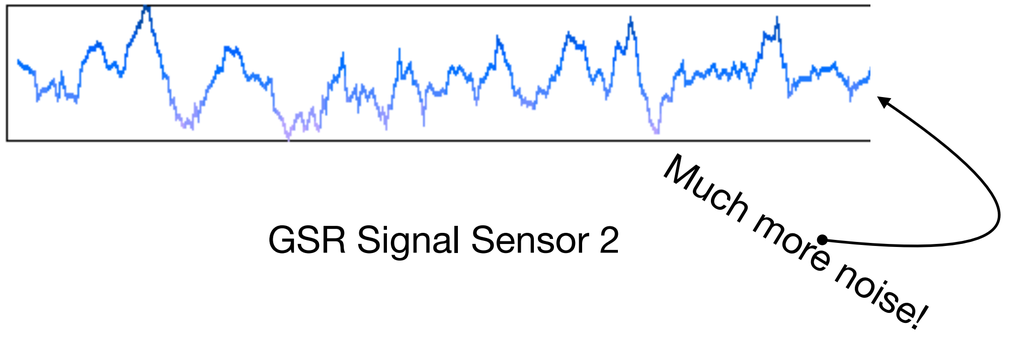
GSR Signal Sensor 2

Fractioned Datasets of Drowsiness

- Bad news: I can not show you exactly this use case (confidential datasets)
- Good news: I have a “surrogate problem”

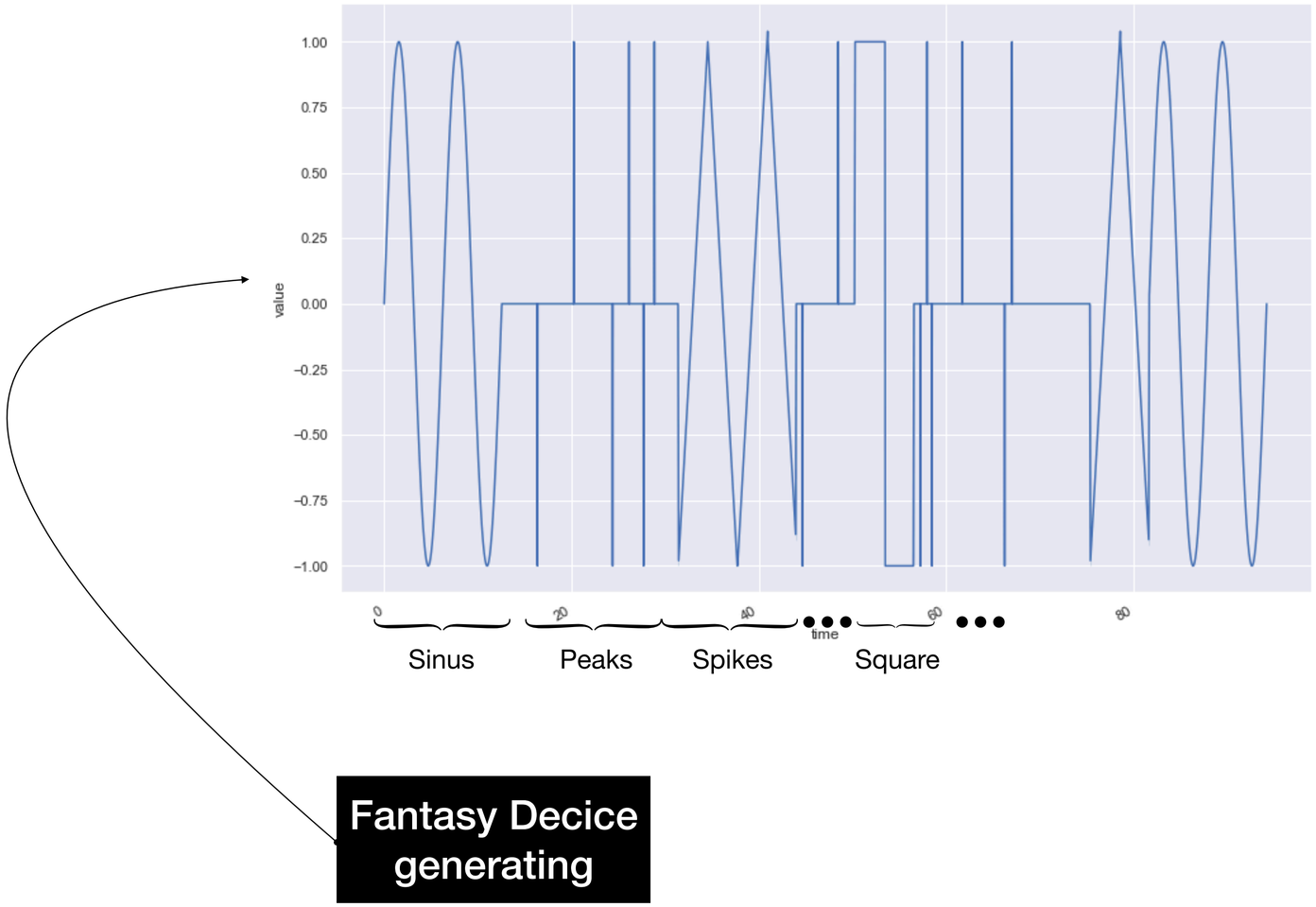


GSR Signal Sensor 1

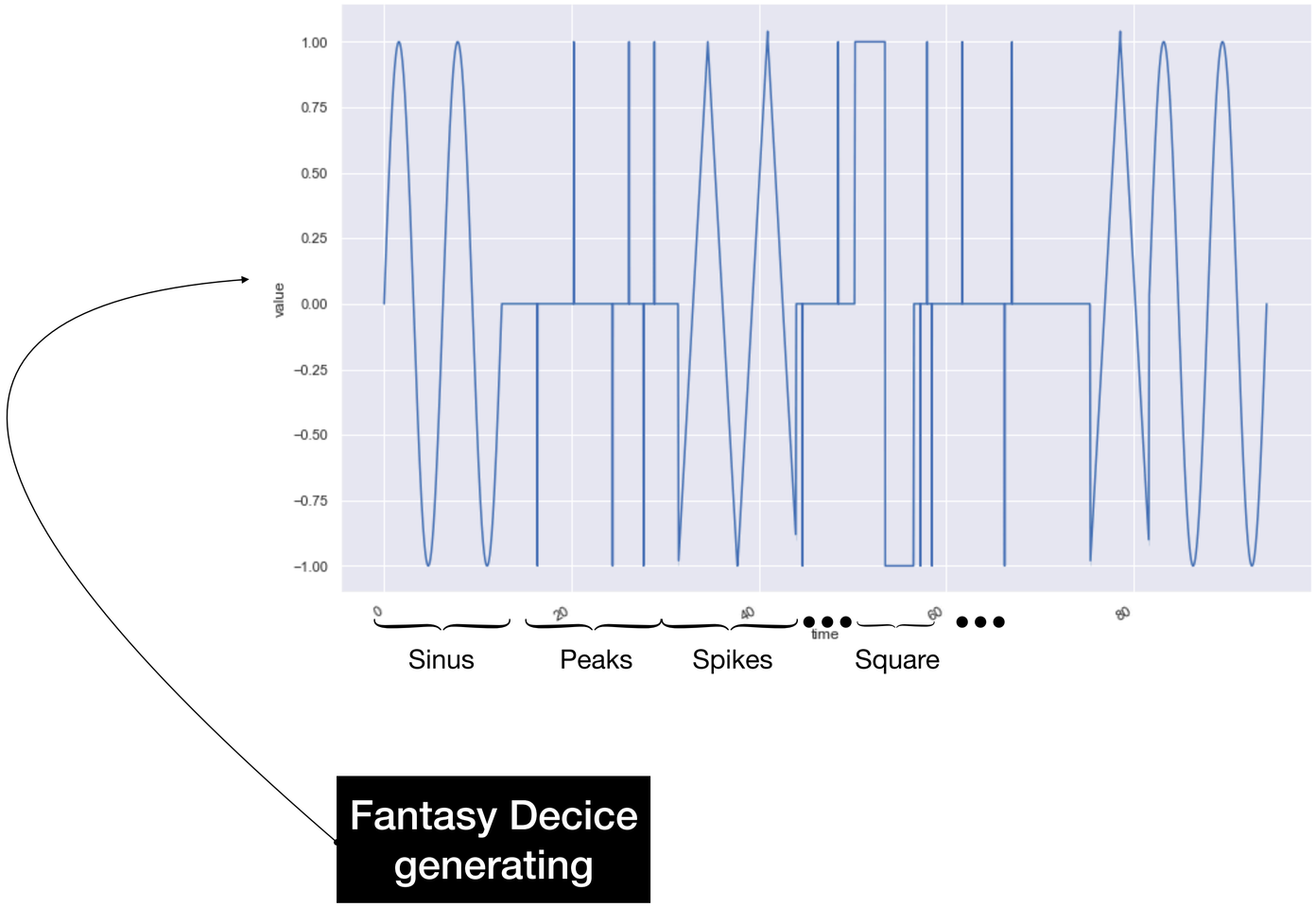


GSR Signal Sensor 2

Unifying Sensor-Recordings for later Supervised Training



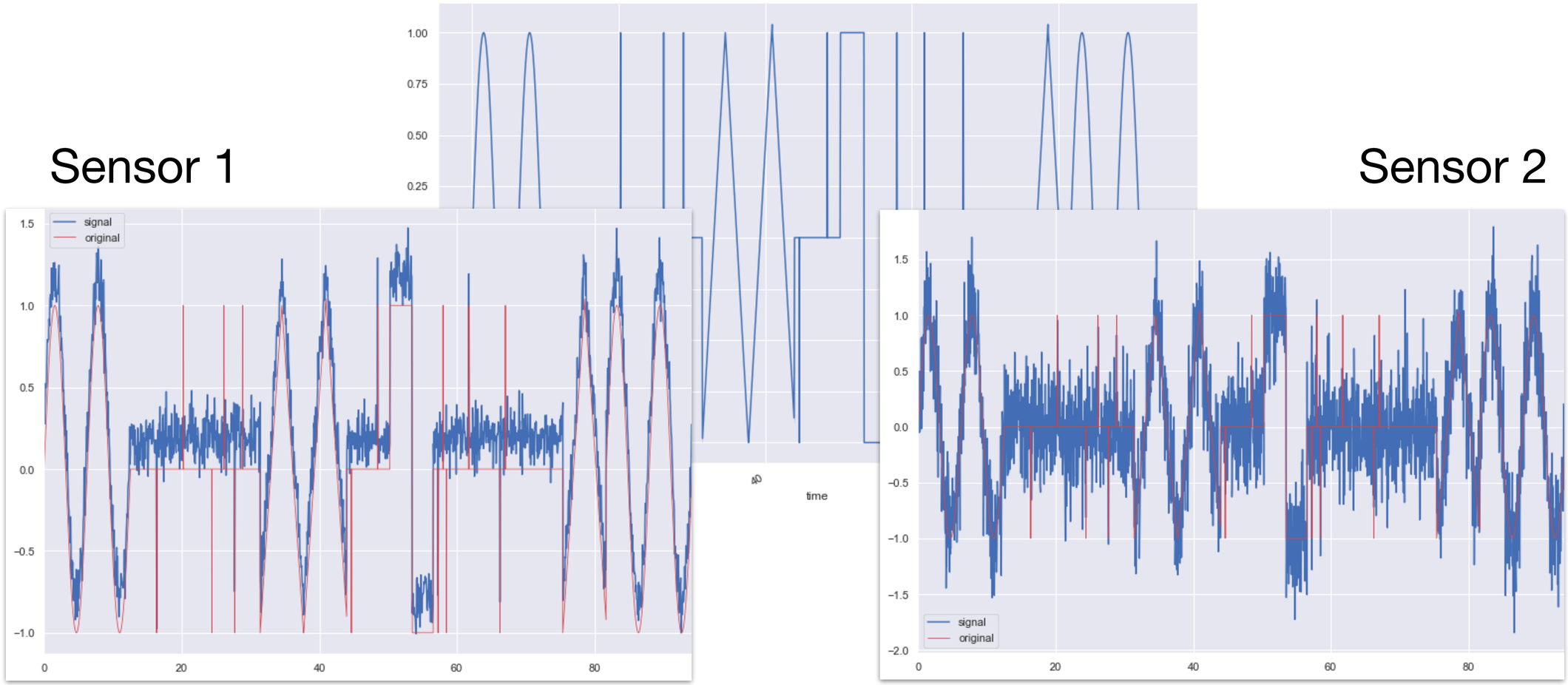
Unifying Sensor-Recordings for later Supervised Training



Fantasy Decice generating

examples/different-sensors-jsimon/problem-description.ipynb

Unifying Sensor-Recordings for later Supervised Training



Unifying Sensor-Recordings for later Supervised Training

- Generate Signal w. 4 modes
- Generate Noise Sensing the Signal
- Generate Experiments with a variation of signal and own sensor (surrogate to other use case)