Project 6

- One channel EEG sleep staging with open source and open hardware NeuroOn sleep mask

- Project Leader:

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- Participants:

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Goal

Detect sleep stages from single channel differential EEG Δ(FP1, FP2)

Method

- **Preprocessing**
- Features
- Classification
- Jitter removal

Preprocessing

- 11 sleep recordings
  - Each divided into 30s epochs
- Removal of corrupt epochs – NaN
- Removal of one recording with >40% corrupt epochs
- Butterworth Filter, Bandpass 0.5-25 Hz
- Power Spectral Density – Welch

Method

- Preprocessing
- **Features**
- Classification
- Jitter removal

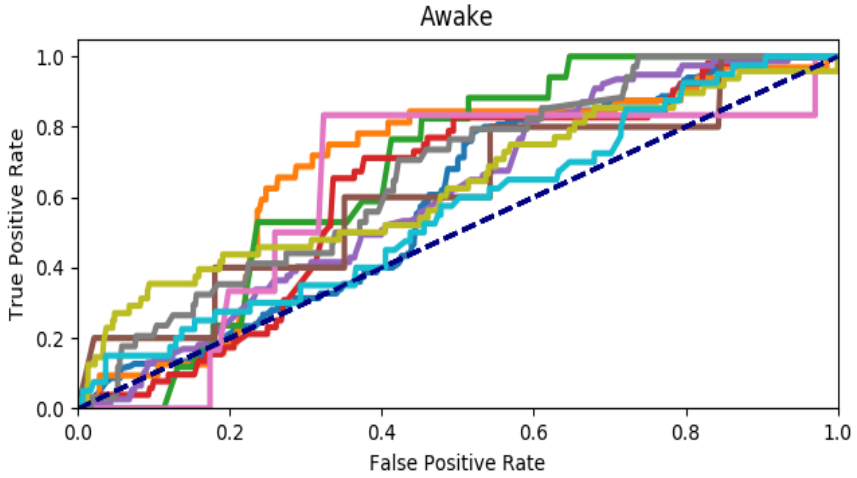
Feature Engineering

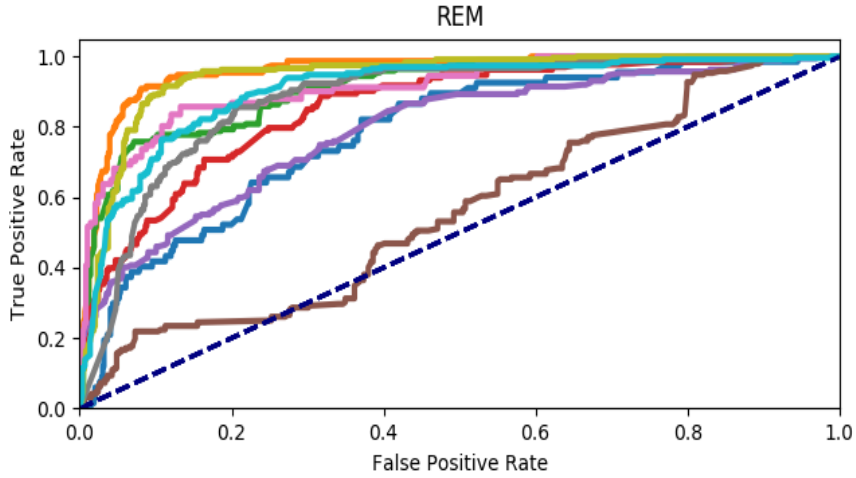
- Power spectrum of different waves (alpha, beta, delta, theta, mu, SMR, K-complexes)
  - Also their logarithms
- Signal mean, stdev, skew, and kurtosis
- Hjorth parameters
- SEF50, SEF90

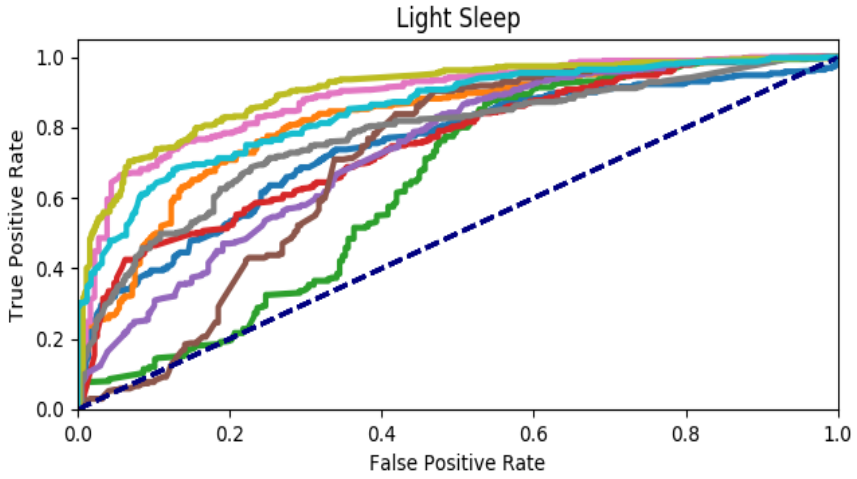
Method

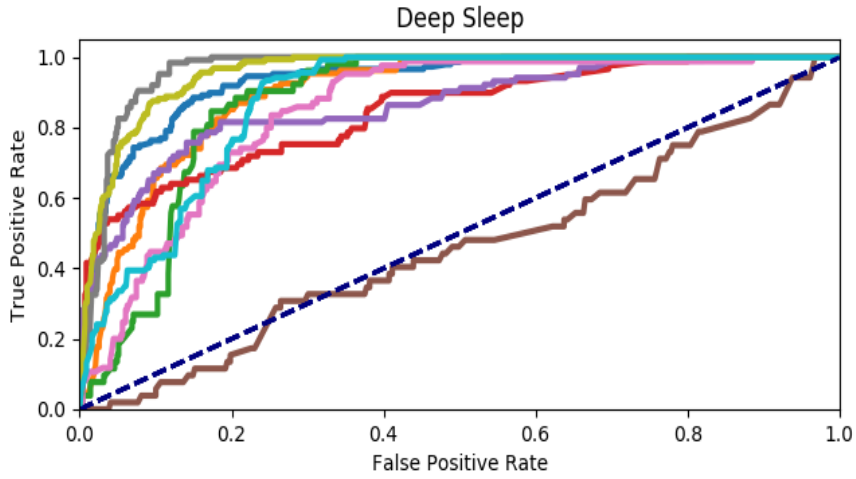
- Preprocessing
- Features
- Classification
  - Linear SVM
  - Not worked: Random Forest, CNN ¯_(ツ)_/¯
- Jitter removal

ROC Curves

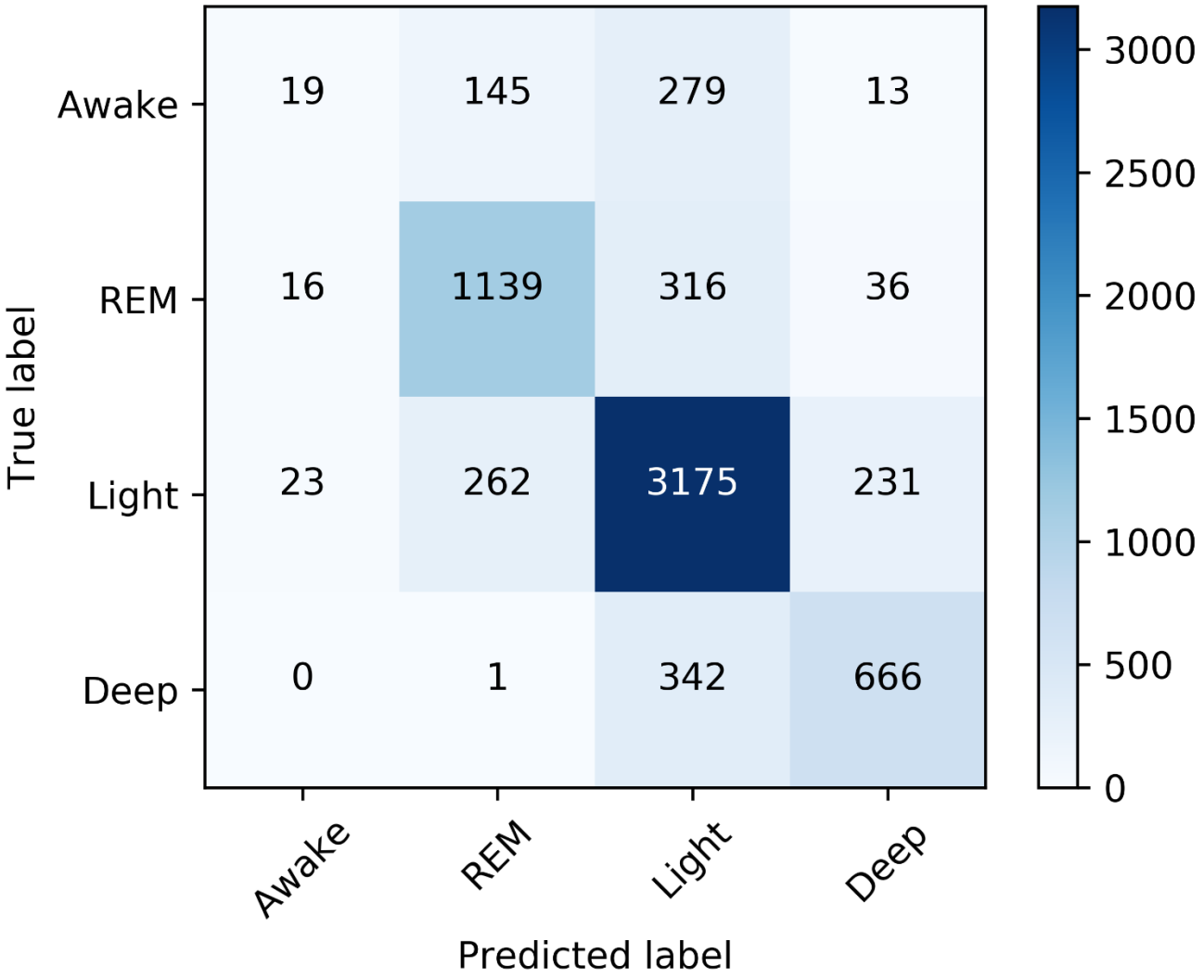

Awake
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0


REM
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0

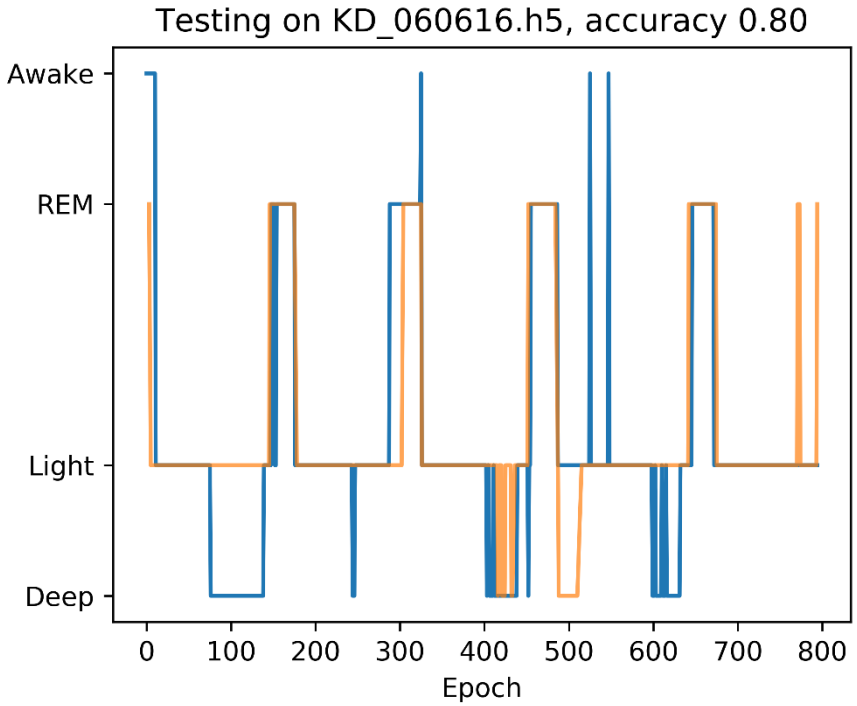

Light Sleep
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0

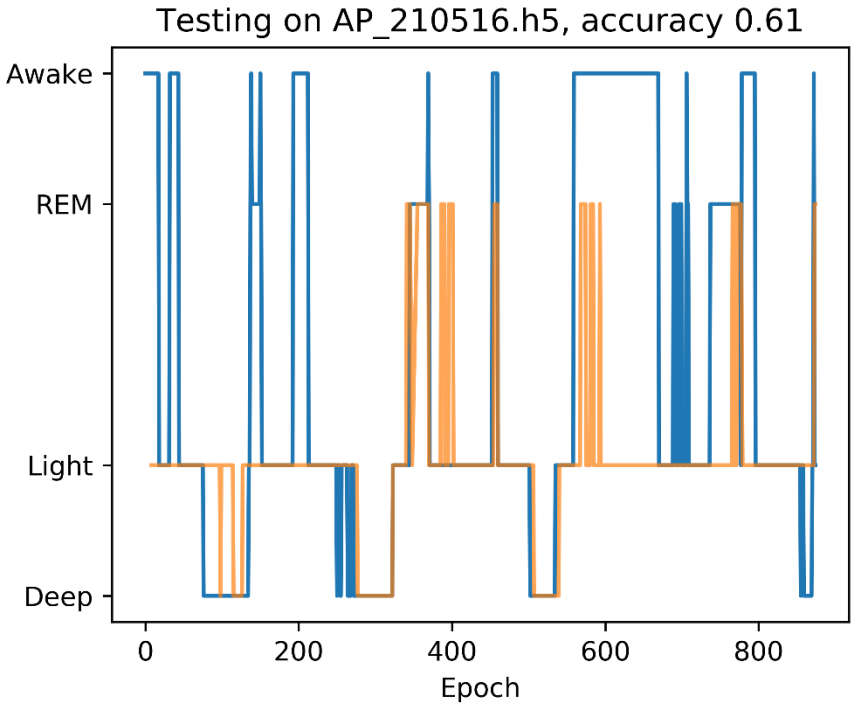

Deep Sleep
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0

Confusion Matrix



Classification results



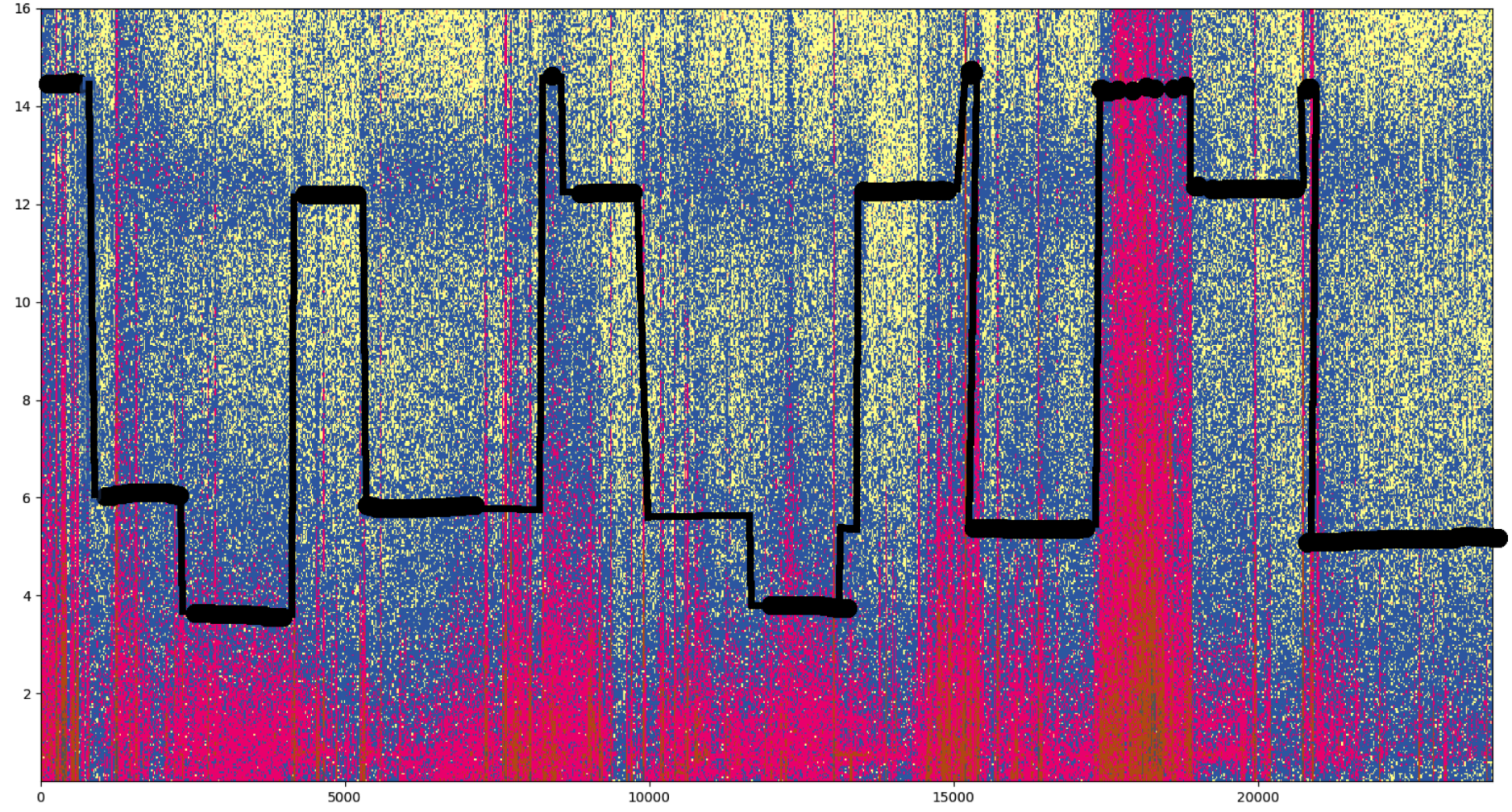


Reference, Classification

Conclusion

- Accuracy 75±6 % on Δ(FP1, FP2)
  - State of the art:
    - 90% on Pz-Oz [1]
    - 77±4 % on FP1, FP2 [2]

- Does not detect wakefulness well

[1] da Silveira, Kozakevicius, Rodrigues, 2017.
[2] Huang, Lin, Ko, Liu, Su, Lin, 2014.

THANK YOU FOR YOUR ATTENTION