Bio-Fingerprinting applied to polysomnographs

Description

Polysomnography (PSG) is a multi-parametric test used in the study of sleep and as a diagnostic tool for sleep disorders.

The first step in the quantitative analysis of polysomnographic recordings is the classification into 5 sleep stages: wakefulness W, stage N1, stage N2, stage N3 and stage R sleep.

To classify sleep stages, it is important to identify where certain patterns occur, such as sleep spindles.

A sleep spindle is an electroencephalography (EEG) pattern of stage 2 sleep defined as a train of distinct waves with frequency 11–16 Hz (most commonly 12-14 Hz) with duration ≥ 0.5 s.

Target

Sleep stage scoring relies heavily on visual pattern recognition by a human expert and is time consuming and subjective. Thus, there is a need for automatic classification.

Some automatic detectors already exist, but they are not accurate.

The aim of the present project is to demonstrate that the performance of an existent sleep-spindle detector can improve by modifying the algorithm so that it can be adapted to the characteristics of each patient.

The detection of spindles by the algorithm is based on the exceeding of three thresholds for three different parameters: relative power, correlation and rms.

Conclusion

My analysis demonstrates that a spindle detection algorithm can be customized to the subject.

The best method I have tested to personalize the detector is to calculate the three parameter thresholds on the first 10 spindles (or 20, with a higher precision), annotated from the sleep expert. Then using the confidence interval on the mean to set the thresholds.

For the subject on which I have tested this method, the F1-score has increased from 0.48, result of the initial algorithm, to 0.58, result using 20 spindles in input and a confidence level of 50%.