

## **Artifacts processing for sleep stage classification**

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When a patient falls asleep, he transits by different sleep stages, which characterize the quality of his night. To determine these sleep stages, the technicians visually analyzes the polysomnographic signals (PSG) witch have different aspects according to these stages. However, this task requires a lot of time. This is why one generally tries to class them automatically. Then, one is generally faced with the problem of artifacts witch often interfere during feature extraction. Their detection and processing are therefore mandatory before any other classification operation.

### **1. METHODS**

Eight different procedures have been designed and tested to detect artifact such as cardiac interference, slow ondulations, movement artifacts, EOG interferences, amplifier saturations, EOG artifacts, failing electrode and brutal transitions. These methods were developed as well in the temporal field as in the frequency field. We have used parameters that were adjustable. Moreover, as the signal energy distribution in the frequency or time domain varies strongly between subjects, we have chosen thresholds relative to the statistical properties of the considered signal. After the artifacts detection, we ignore the signal parts corresponding to the short duration artifacts and consider only the remaining of the signal for the classification. However, cardiac interferences and slow ondulations could not be processed using this strategy because these artifacts can last several hours. So we have corrected them. The slow ondulations were simply removed by filtering the signal with a cut-off frequency adjusted to the smallest frequency of the delta band. The cardiac interferences extraction was more technical. First, the interference pikes were located with the help of a non-linear energy operator. Then an averaged cardiac interference was calculated for each epoch (assuming stationary of interference) and was subtracted from the related signal. Finally, 21 nights from normal subjects and 33 nights from pathological subjects were used to correctly tune our parameters and test our detection/correction process.

### **2. RESULTS - CONCLUSION**

The results are satisfying since the artifacts seem to be correctly detected by our processes (this was visually evaluated). More over, it has been possible to extract correctly the longer artifacts such as cardiac interference or slow ondulations. So in our future work, we hope that it will permit to improve the recognition rate of sleep stages.