Multi-feature probabilistic detector applied on apnea/hypopnea monitoring

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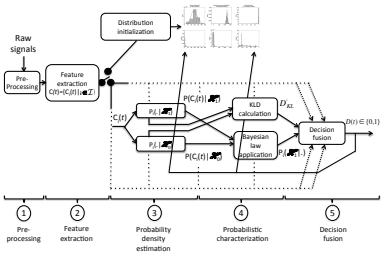
Introduction Robust, real-time apnea and hypopnea detection for sleep apnea syndrome (SAS) patients monitoring still represents a major challenge due to noise artifacts, the complexity of respiration patterns and inter-subject discrepancies. We propose in this study the application of an original multi-feature probabilistic detector (MFPD) for SAS monitoring.

Method Only the breathing waveform (nasal airflow) is used to derive a set of respiration features (variance, mobility, peak-to-peak amplitude and total respiration cycle), and a binary detection probability is updated from a centralized fusion using the Kullback-Leibler divergence (KLD). As a key in the feature statistic learning process, the KLD tracks the separability of the event-vs-no-event distributions of each feature. While the optimal feature set selection lies beyond the scope of our study, we illustrate however the ability to adapt each feature's weight dynamically in the fusion.



Global architecture of MFPD for online detection from statistical learning

Results and conclusion The detector is under test for 43 severe OSA patients undergoing a full PSG sampled at 1024Hz. True positive events are defined as less than 10 sec before or within the annotated events (including both apnea and hypopnea), other detections are noted as false positives while true negatives are those annotated events without corresponding detections in the same ranges. A total of 4240 events are annotated, while each recording file constitutes an independent test since feature statistic learning is performed as per recording based on past apnea/hypopnea detections as explained in the above. Some partial results are reported in this abstract.

Statistics per recording

Rec ID	Tot Annot events	TP	FP	FN	SE (%)	PPV (%)
FRGNB4IAHO02010	335 (6.4 Hrs)	335	0	0	100	100
FRGNB4IAHO02009	476 (6.1 Hrs)	455	12	21	95	97