Automated Sleep Arousal Detection Based on EEG Envelograms

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Background: Sleep arousal is basically described as a shift in EEG activity in frequencies > 16 Hz for a duration > 3 sec (by the American Sleep Disorders Association – ASDA). The number of these arousals during sleep is a reflection of sleep quality. In accordance with the PhysioNet/CinC Challenge 2018, we present a method for automatic detection of arousals in polysomnographic recordings.

Method: Each file in the training dataset (N=994) has defined “Arousal Regions” (AR, median length 32 seconds); however, arousals were usually located in the right half of these ARs. Therefore, we built a method with respect to ASDA criteria to locate arousals inside ARs: envelograms (14-20; 16-25 and 20-40 Hz) were inspected in a 3-sec floating window for an increase against a 10-sec background for more than 3 secs. We then extracted 159,840 blocks passing ASDA criteria from AR regions as well as outside ARs (1:3). We extracted 24 features from these blocks (how many EEG channels/frequency bands passed ASDA criteria; heart rate before/during arousal; airflow and EMG changes) and trained a bagged tree ensemble model (70/30% held-out).

Results: The method showed AUROC/AUPRC 0.79/0.18 on a training set and AUROC/AUPRC 0.74/0.13 on a testing set. {fplesinger@isibrno.cz}