Deep Convolutional Neural Network for Automated Labeling of Home Sleep Apnea Tests

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Background.
Scoring Home Sleep Apnea Test (HSAT) is a manual task of visually analyzing temporal data from several body sensors to identify apnea events which are used for scoring. Convolutional neural networks, which have recently achieved expert-level performance for other complex medical tasks including polysomnography scoring, are well suited to HSAT scoring.

Methods.
We used a 1-dimensional convolutional neural network (CNN) for supervised learning of clinical labels of apnea events. The data for testing and training included raw sensor data derived from 768 clinical HSATs with apnea events manually labeled by sleep technicians.

Results.
30-second intervals were sampled from the clinical HSAT data, resulting in 114,500 samples. These were labeled as one of 4 classes: containing an obstructive apnea, obstructive hypopnea, central apnea, or none of these (negative). The CNN was trained on 90% of the data and tested on the hold-out set. Multi-class classification accuracy was 76%.

Conclusion.
We demonstrate promising accuracy for classification of 30-second segments of raw sleep study data. Larger data sets and improved architectures could improve this accuracy, and such models could be used to automate the scoring of HSATs, decreasing time and cost of the diagnosis of sleep apnea.