Obstructive Sleep Apnea Screening Using Spectral and Bispectral Features of Breathing Sounds in Wakefulness

Davood Karimi
Dept. Electrical & Computer Engineering
University of Manitoba
d_karimi@umanitoba.ca

The goal of this study was to investigate the potential of tracheal breathing sounds recorded during wakefulness for screening of obstructive sleep apnea (OSA) patients. Breathing sounds were recorded from 189 subjects during nose and mouth deep breathing in supine and sitting postures. Characteristic features were extracted from the power spectrum density and bispectrum of the signal. The subjects were divided into three groups based on their apnea hypopnea index (AHI): non-OSA group (AHI<10; n=105), middle group (10≤AHI≤20; n=32), and the OSA group (AHI>20; n=52). The data from 35 non-OSA and 35 OSA subjects were used to select the best subsets of the features. Classification was based on building a minimum-distance classifier for each feature and a majority vote approach to decide the class prediction. A leave-one-out scheme was used for evaluating the classification performance. For the non-OSA and OSA subjects in the testing dataset, the highest classification accuracy, specificity, and sensitivity were 78%, 77%, and 82%, respectively. The classification accuracy for the subjects in the middle group with a threshold of AHI=15 was 61%. In addition, an approach for classification based on six risk OSA factors, including age, gender, body mass index (BMI), neck circumference, Mallampati score, and smoking history, was investigated. For non-OSA and OSA groups, the accuracy, specificity, and sensitivity of this approach were 68%, 76%, and 35%, respectively. Parallel classification by both methods resulted in a highly sensitive (>90%) screening of OSA subjects at the cost of low specificity (~60%). The proposed wakefulness screening method can lead to significant improvement in efficient use of expensive resources such as overnight sleep laboratories.