

Automated classification of sleep apnea-hypopnea events using thoracic effort features.  
5th ERS/ESRS Sleep and Breathing Conference. Kumar, S. & Dash, S.

# Sleepiz Automated Detection of Apnea-Hypopnea Events using Thoracic Effort

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## Problem Definition

**Sleep Apnea**  
High comorbidity

**1B people**  
Less than 20% are diagnosed

## Diagnostic Solution

	Accuracy	Comfort	Long-term Monitoring	Set-up time	Cost
Polysomnography	High	Low	Very low	60-90 min	High
Polygraphy	Medium	Medium	Medium	30 min	Low

Apnea-Hypopnea Index (AHI) Overestimation

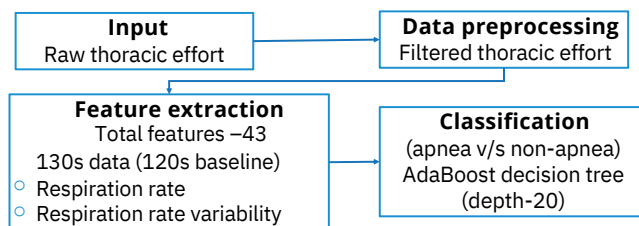
Nasal Cannula

## Method

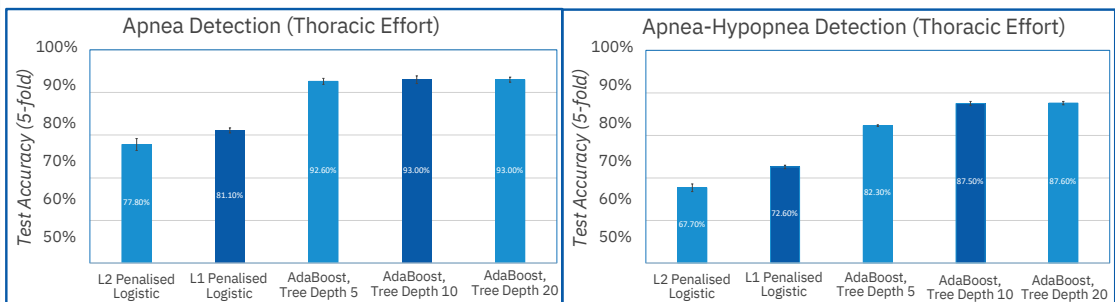
### Characteristics of Sleep Datasets

Database	SVUH / UCD ( 25 nights)	
Gender	Male 21	Female 4
Age	28 $50 \pm 9$	68
BMI	25.1 $31.6 \pm 4$	42.5
PSG AHI	2 $24 \pm 20$	91
Sleep score	58 $77.2 \pm 10.9$	92

### Algorithm



## Results



## Conclusions

- Proposed model AdaBoost could provide a comfortable screening solution for sleep apnea
- Logistic Regression does not identify nonlinear patterns from apnea-hypopnea detection
- AdaBoost models are more consistent than penalized logistic regression for apnea-hypopnea detection

## References

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## **Automated detection of apnea-hypopnea events using thoracic effort**

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Sleep apnea (SA) is a common sleep disorder with high prevalence among people. Most screening devices use nasal canula to measure airflow that are uncomfortable to patients' sleep habits. Thoracic effort channel could provide promising solution for clinical grade apnea screening. The aim of this study is to evaluate the performance of apnea-hypopnea event detection method based on thoracic effort using the method AdaBoost. We used the St Vincent's University hospital/University college Dublin SA database that contains 25 patients with AHI varying from 5 to 91. We preprocessed thoracic effort by using Butterworth bandpass filter and extracted various features from the 130-seconds filtered signal window by considering first 120s as baseline. 43 different features were computed, containing statistics from respiration rate and time-frequency domain features from respiration variability. We applied AdaBoost algorithm with decision tree (DT) as base estimator to detect apnea-hypopnea events and evaluated it using 5-fold cross validation. By employing the base learner DT of maximum depth 20 to AdaBoost, we got test accuracies 93+0.6% for only apnea detection and 87.640.4% for apnea-hypopnea detection. We compared predicted models with L1-penalised logistic regression and the result shows an improvement in accuracy by 11.9% and 15% respectively. This is mainly because logistic model does not identify nonlinear relationships among features. The results demonstrate that the proposed model could provide a comfortable screening solution for SA.

# Sleepiz



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