

# RECOGNITION OF SLEEP STAGES FROM SENSOR DATA

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## ABSTRACT

Long term sleep monitoring can help diagnose sleep disorders and other diseases that may change sleep patterns. But the traditional Polysomnography (PSG) system is not comfortable, with various sensors connected to the body. So a comfortable, home-use system is needed for sleep monitoring.

In this work, the sleep stage recognition problem using three different sensors were studied: a bed sensor that produces a ballistocardiogram (BCG) signal, an ECG, and an oro-nasal airflow sensor. The work focused on recognition of Awake, rapid-eye movement (REM) and non rapid-eye movement (NREM) stages. Data from the bed sensor was collected on one healthy subject with a Mindo-Hydra wearable EEG device as the ground truth. Data from the ECG and the oro-nasal airflow were obtained from two public databases: the MIT-BIH Polysomnographic Database (MITBPD) and the Sleep-EDF Database (Expanded), respectively. The support vector machine (SVM) classifier and a threshold comparison classifier were tested with the three databases. Heart rate variability (HRV), respiratory variability (RV) and linear frequency cepstral coefficients (LFCC) features were extracted from the signals.

The LFCC features, as a new type of feature applied to sleep stage recognition, was found to be useful to improve the classification performance. The result with the MITBPD exceeded previous work using the same database. The result with the sleep-EDF is comparable with previous literature using different databases, but the proposed method in this work only used 2 features.