Public Abstract

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Sleep is an essential activity for humans. It affects our physical and mental health. So monitoring sleep continuously can help detect any changes in sleep patterns that may be caused by sleep disorders or other diseases. For a long term sleep monitoring system, the most important requirement is comfort. The less the system contacts with the body, the better it is.
The hydraulic bed sensor developed by university of Missouri (MUHBS) is such a sensor. It is placed under the mattress and hence, it has no contact with the body. The ultimate goal of this work is to recognize sleep stages using this non-invasive bed sensor. Sleep data were collected with this bed sensor and a Mindo-Hydra wearable EEG device as the ground truth. The EEG device detects our brain waves by wearing it on the forehead. The processing of the brain waves provided the sleep stages detected by its automatic algorithm.
The sleep stage recognition system which classifies Awake, REM and NREM sleeps was then developed with this collected data. But, due to the lower accuracy of this ground truth, the performance of the developed method wasn't truly reflective of actual sleep stages. For the purpose of verifying the developed methods, two other databases: the MIT-BIH Polysomnographic Database (MITBPD) and the Sleep-EDF Database (Expanded) were also studied here. Similar features as extracted from the bed sensor dataset were calculated from these two databases.
The result with the MITBPD exceeded previous work using the same database. The result with the sleep-EDF was comparable with previous work using different databases, but the proposed method used simpler features. Thus, performances of these two databases verified that the developed method are useful to solve sleep stage recognition problem. It further showed the potential of monitoring sleep using the MUHBS, if a reliable ground truth system can be obtained.