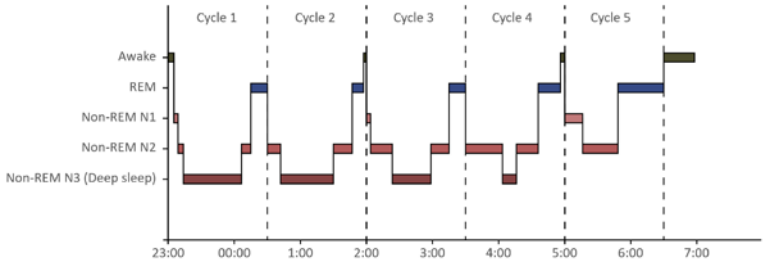
MSc/BSc-project

Sleep detection using in-ear non-contact sensors

Introduction:
Conventional sleep detection systems are cumbersome or inaccurate. These ranges from highly complex medical systems, consisting of a large number of sensors, to apps, which claim to be able to detect sleep stages. The former one being very precise, but cumbersome and not for home use, while the apps are very imprecise. The current sleep studies rely on large amounts of electrophysiological data to be recorded from a patient, which is then analyzed by doctors and sleep technicians. This analysis is very time-consuming, which is why there is a huge interest in automated sleep analysis systems in current research. Previous research in non-contact sensor-based sleep analysis found that some sleep microstructures could possibly be identified using the non-contact sensors, e.g. photoplethysmogram (PPG), temperature, microphone and accelerometer. However, the extent and accuracy of this is unknown. Research in an ear-based sensor fusion does not exist. Further research is needed in order to validate whether it is possible to classify sleep stages and / or other sleep-related symptoms using only non-contact sensors in a sensor fusion. The ear is an obvious place to detect these bio-medical signals.



Objective and research hypothesis:
This project will investigate the possibility of classify relevant sleep information using in-ear non-contact sensors. This project might take different directions:

- Classification of sleep / wake
- Classification of sleep stages (N1, N2, N3 and REM sleep)
- Classification of sleep apnea symptoms

Description:
The project will be based on a non-contact sensor-based in-ear monitor. The students will then build and apply a sleep microstructure classification algorithm on top of this monitor and evaluate the performance relative to gold-standard scoring by doctors and sleep technicians. The project is performed in research collaboration with the Danish Centre for Sleep Medicine, Rigshospitalet Glostrup. Data will originate from online sleep study databases and/or clinical recordings.

Max number of students: 2

Prerequisites:
Experience with MATLAB, signal processing and machine learning.

Supervisors:
Assoc. Professor MSK PhD Helge B.D. Sørensen, DTU Elektro
Professor, Chief Physician DMSc Poul Jørgen Jennum, Rigshospitalet, Glostrup

Contact:
Assoc. Professor MSK PhD Helge B.D. Sørensen, DTU Elektro hbs@elektro.dtu.dk

Medicinsk signalbehandling