MSc/BSc-project

Detection and quantification of sleep microstructures in EOG signals

Introduction:

Conventional sleep studies rely on a large amount 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. Furthermore, the large number of data recording modalities may interfere with normal sleep patterns and are maybe unnecessary in situations such as home-based sleep studies. Previous research in automatic EOG-based sleep analysis found that some sleep microstructures could possibly be identified using the EOG channels alone, however the extent and accuracy of this is unknown.

Reference: Mindmedia.com

Sleep microstructures encompass sleep spindles and K-complexes, which are biological waveforms mostly present in the EEG. They are believed to be associated with synaptic plasticity, memory consolidation, and sensory stimulation, while also being the hallmark traits of non-REM stage 2 sleep. *Changes to the morphology of these microstructures are observed in neurodegenerative diseases, autism, epilepsy and sleep disorders, and it is therefore crucial to be able to efficiently and accurately automatically identify these sleep events using efficient biomedical signal processing..*

Objective and research hypothesis:

This project will investigate sleep spindle detection under the hypothesis that sleep spindles and other microstructures can be accurately and efficiently detected using EOG signals exclusively.

Description:

The project will be based on an EOG-based decomposition framework using empirical mode decomposition. The students will then build and apply a sleep microstructure detection algorithm on top of this framework 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:

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Medicinsk signalbehandling