

MSc project

Title:

Automatic detection and characterization of nocturnal eye movements (A collaboration between DTU and Danish Center for Sleep Medicine, Rigshospitalet, Glostrup)

Introduction:

The basic understanding and classification of sleep staging relies on a classification dating back to 1968 by Rechtschaffen and Kales. It divides sleep stages into Rapid Eye Movement (REM) and Non-REM (NREM) sleep. Central to this classification is polysomnography (PSG) which assess complex electrophysiological signals including brain activity measured by electroencephalography (EEG), eye movements measured by electrooculography (EOG), motor activity by electromyography (EMG) and several other physiological modalities. The current sleep classification relies on visual identification of specific patterns in the PSG signals, and traditionally, the huge amount of data recorded is tremendously downsized to a simple diagram (called a hypnogram) summing up the overall sleep architecture of the recording night. Therefore, the simplistic analysis performed in the PSG data does not take into account important but unexploited macro and micro sleep events. This results in limitations for both diagnosis and a deeper understanding of the disease pathophysiology.

This project will exploit the micro sleep event *eye movements* that traditionally are identified as either rapid (characteristic for REM sleep) or slow. Not many details are stated and not much is known about the physiology or meaning of the different types of nocturnal eye movements, but due to the neurons involved in controlling them, it is of utmost importance to detect and characterize them to forward the analysis and understanding of sleep in health and disease.

Objectives:

The Danish Center for Sleep Medicine has developed a detailed routine for identification and labeling of nocturnal eye movements, and has gathered data from two different experts. Using this dataset, this project will be one of the first aiming at 1) developing detectors for slow and rapid eye movements, and 2) extracting features that can help in characterizing (and defining) the different types of nocturnal eye movements.

Supervisors:

Assoc. Professor Julie A. E. Christensen, DTU Elektro/Danish Center for Sleep Medicine
Professor, MD Poul J. Jennum, Danish Center for Sleep Medicine, Rigshospitalet, Glostrup

Prerequisites:

Experience with Matlab, signal processing and machine learning is required.

Contact:

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