Sleep state classification using ECG

Background

Detecting sleep stages (sleep staging) is important for diagnosing several diseases, but it can also be a valuable tool in healthy people. The gold standard in sleep stage classification relies on the polysomnogram (PSG), which monitors vital body functions such as brain activity, eye movement, muscle activity, heart activity, and respiration. With these numerous modalities, PSG recording devices are expensive and usually only available in specialized sleep monitoring laboratories. Therefore, only patients with specific symptoms are normally admitted to such sleep-related diagnostic tests.

However, sleep staging could also be relevant for the healthy population, because parameters related to stress are thought to be related to sleep quality in general and the sequence of sleep stages in particular. Therefore, a method which reliably classifies the different sleep stages based only on the electrocardiogram (ECG) would be highly relevant for such a use case.

To date, only a small number of scientific studies on ECG-based sleep stage classification have been published. Crucially, none of these studies are reproducible or replicable, because neither the data nor the methods described in these publications are publicly available.

Project

The goal of this project is to develop an ECG-based classifier to differentiate between the three sleep stages wake, REM sleep, and non-REM sleep. Using state of the art machine learning techniques, the performance of the developed method will be evaluated on a large public data set. Importantly, the final version of the sleep stage classifier will be released as an open source toolbox. Finally, we have already recorded several hundred all-night ECG data sets, which we would like to subject to the ECG-based sleep stage classifier.

Contact

If you are looking for a master thesis topic and have a solid background in signal processing, machine learning, and Python please feel free to contact me at:

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