6/22/2016

Today's Goal: Choose features+classifying/clustering algorithms

Note: rms Power=Square Root of Sum of Squares divided by total time.

Do FFT on data. Take logarithm of frequency if necessary. Usually you band pass 0-50Hz for artifacts.

Features:

Individual Features:

Sum of Square EEG Delta Wave Power (0.5-4 Hz)
Sum of Square EEG Theta Wave Power (5-9 Hz)
Delta/Theta Ratio
Ratio between Mean-squared EEG power in high frequency (9–45Hz) and low frequency (0.5–9Hz)
RMS EMG Power (20-300 Hz), Band pass filter for 10-40 Hz or 80 to 100Hz
Entropy of EEG Delta Wave
Entropy of EEG Theta Wave
Entropy of EMG Signal

Total Signal:

Entire EEG/EMG Channel (w/ maybe some band pass filtering)—>PCA. Use best components.

State Notes:

Waking is generally defined by a low amplitude high frequency EEG. Some systems differentiate active wake (large amplitude EMG concomitant with predominant EEG theta-activity) from quiet wake (lower EMG amplitude combined with less prominent EEG theta-activity)

NREM sleep was generally typified by a high amplitude EEG associated to a low voltage EMG. The presence of high EEG delta activity (0.5–4 Hz) is also employed to characterize this state.

REM is commonly defined by a low amplitude high frequency EEG associated with an absence of EMG activity. The presence of EEG theta-activity (6–10 Hz) in the recording can be used to confirm this state.

Classifiers:

Hidden Markov Model w/ Viterbi or Expectation Maximization - Good for modeling state transitions
Naive Bayes Classification w/ Gaussian Assumption- Probabilistic Approach
k-means clustering- Very fast but very sensitive to noise
Self Organizing Map Neural Network

Important papers:

FASTER: an unsupervised fully automated sleep staging method for mice
Automated sleep scoring in rats and mice using the naive Bayes classifier.
SegWay: A simple framework for unsupervised sleep segmentation in experimental EEG recordings