UNIVERSITÄT LEIPZIG

Fakultät für Mathematik und Informatik | Institut für Informatik
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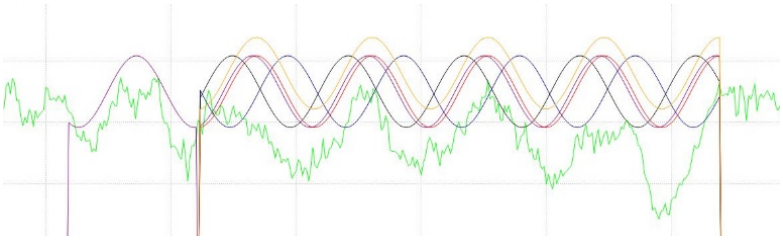

Analysis of alpha waves phase extraction and prediction methods for electroencephalography (EEG) signals

Among a broad spectrum of brain frequencies measured with electroencephalography (EEG), Alpha (8-13 Hz) is one of the most prominent waves in signal processing and computational neuroscience. It is linked to many functions such as perception, attention and working memory. Alpha waves can be described in terms of frequency, amplitude, phase and other metrics, which allow to investigate its dynamics and functional role in various states and conditions.

In general, phase of alpha has rapid dynamics and can not be determined in the one optimal way, extraction and prediction are strongly depends on many factors such as time intervals, filter parameters and phase expression level. Currently, there is no published research focused on this topic, in case of conducted comparisons – it usually has only couple methods and couple metrics.

The goal of this project is to analyze existing approaches for alpha phase extraction and prediction in terms of different metrics on a given EEG data sets. The work will include application of standard filters and frequency transformations to EEG data, implementation of phase prediction methods (FFT-based, Autoregression-based, Hilbert-based) and evaluation metrics, comparison of performance on artificially generated and real EEG data sets. Additionally, novel methods for phase prediction can be developed (such as with Nonlinear Autoregressive Exogenous Neural Network or other Artificial Neural Network).

Requirements:
- Basic knowledge of signal processing
- Programming experience in Matlab / R / Python

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Masterarbeit

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