081 - Modelling of Time-varying HRV using Locally Stationary Processes

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I. Introduction & Aim

Estimates of heart rate variability (HRV), and particularly parameters related to high frequency HRV (HF-HRV), are increasingly used as a proxy of cardiac parasympathetic nervous system regulation. Reduced HF-HRV is related to attention deficits, depression, various anxiety disorders, long-term work related stress or burnout, and cardiovascular diseases [1,2]. In this work, a stochastic model, known as *Locally Stationary Processes*, [3], is applied to HRV data sequences from 47 test participants. The model parameters are estimated with a novel inference method and regression using a number of available covariates is used to investigate their correlation with the stochastic model parameters.

II. Methods

A. Test Description

The test participants (TP) were told not to ingest food, caffeine, or tobacco during the 2 h before the experiment or alcohol the day before lab visit. Patients using medicines or suffering form any disease known to affect the cardiovascular system were not included. ECG and respiration were recorded at 1 kHz. ECG was assessed using disposable electrodes and respiration using a strain gauge over the chest. 5 min of data were recorded when the TP was breathing in accordance with a time-varying metronome beginning at 0.12 Hz and ending at 0.35 Hz.

B. Data Preprocessing

The raw data sequences (respiratory data and HR data) were downsampled to 4 Hz, i.e. in total 1200 samples for each sequence. After adjusting to zero-mean, both respiratory and HR data were filtered with a band-pass FIR-filter of length 256 of 3 dB-bandwidth 0.1-0.5 Hz. The first and last data samples were corrupted from the transient of the filter and as data for the further analysis, the middle 960 samples (4 minutes) were used.

C.Stochastic model and regression

The stochastic model considered, known as *Locally Stationary Processes (LSP)*, is based on the modulation in time of a stationary covariance function. A novel inference methodology based on the separability properties possessed by the model covariance is used to estimate the model parameters for every participant in the study. A generalised linear model with the LSP parameters as response is fitted to investigate their correlation with a number of covariates, including age, gender, height, weight, BMI, and stress level.

Compliance with Ethical Requirements

Data collection took place at the Department of Laboratory Medicine, Division of Occupational and Environmental Medicine, Lund University. The study was approved by the central ethical review board at Lund (Dnr 2013/754) and was conducted in correspondence with the Helsinki declaration. All participants signed an informed consent that clearly stated that participation was voluntary and could be discontinued at any time.

Conflict of interest

The authors declare that they have no conflict of interest.

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