

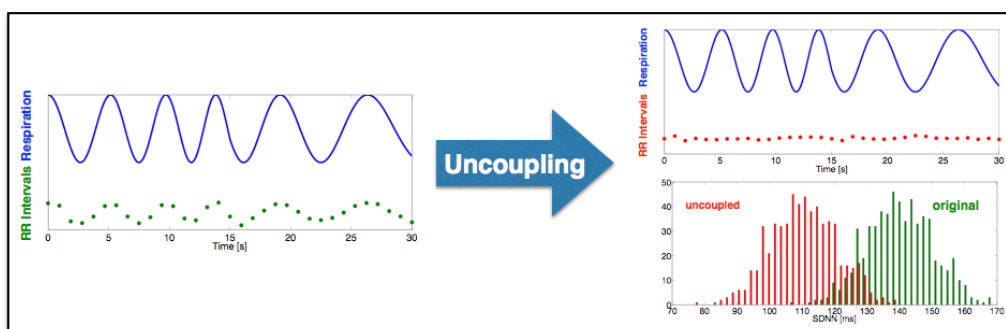
## Master Thesis

# Removing the effect of respiration on the heart rate variability and quantifying the medical impact of the new uncoupled parameters when estimating risk of cardiac death

### Motivation

The respiratory sinus arrhythmia (RSA) is a physiological phenomenon in which the respiration cycle modulates the heart rate. In this event the heart beats faster during inspirations and slows down when expiring. On the other hand, the heart variability (HRV) is an accurate way of measuring the great amount of physiological and pathological processes that also modulate the normal rhythm of the heart. It has been shown that patients presenting pathological states including diabetes, renal failure, myocardial infarction and cardiac arrhythmias among others tend to have a modified HRV. However, this measurement could be corrupted by a strong RSA and an accurate HRV parameter estimation might not be possible.

Therefore, it can be postulated that removing the effect of respiration on the HRV could deliver further insights on the pure physiological state of the heart. The uncoupled HRV parameters might have a stronger prediction when estimating risk of cardiac death.



### Tasks

In this project, an algorithm to remove the effect of respiration on HRV should be developed. For this purpose, the existing algorithm based on notch filtering should be extended to adapt in time and include more spectral information. Furthermore,

### Requirements

- Literature research
- Programming skills in MATLAB and SPSS
- Strong fundamentals of signal processing
- Data mining and statistics in medicine
- Ideally some fundamentals of cardiac physiology

### Field of Research

Signal processing of the ECG

### Project

Supported by the German state of Baden-Württemberg

### Areas

Signal processing  
Software programming  
Algorithmic  
Biomedical engineering

### Field of Studies

Electrical engineering  
Computer science

### Starting Date

October 2014

### Contact

Dipl.-Ing. Gustavo Lenis  
Geb. 30.33, Raum 507  
Fritz-Haber-Weg 1  
76131 Karlsruhe

### eMail

gustavo.lenis@kit.edu

### Phone

+49 721 608-42791

