Karlsruher Institut für Technologie

Institute of Biomedical Engineering

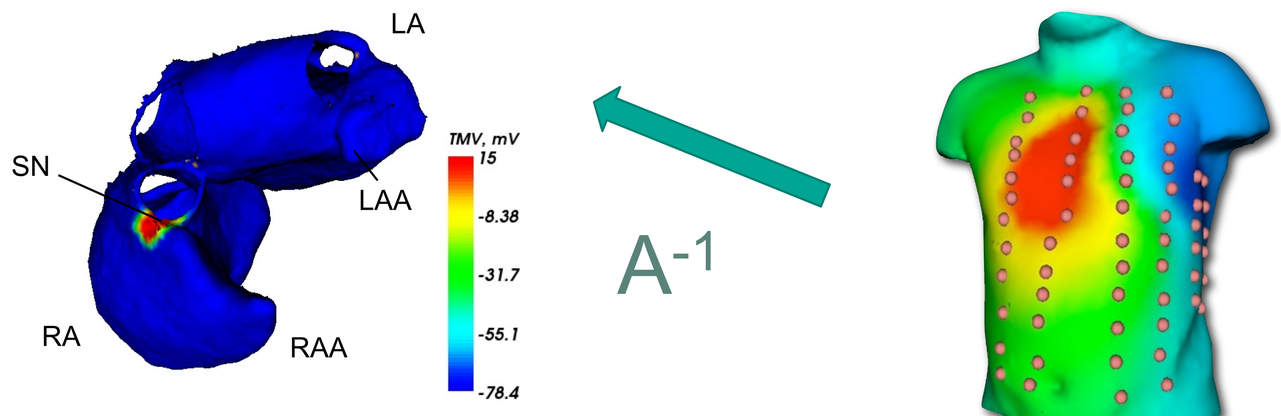
Master Thesis/ Diplomarbeit

„A Wavefront-Based Approach to Non-Invasive Reconstruction of Myocardial Activation“

Motivation

The visualization of cardiac muscle excitation from ECG measurements (ECG Imaging) is a problem of great clinical relevance that is mathematically ill-posed. It can only be solved by introducing *a-priori* knowledge on the reconstructed sources into the solution (regularization).

Traditional regularization methods are mostly unsatisfying since they are based on the assumption that the electric sources have a smooth distribution. It is, however, well-known that cardiac potentials have sharp edges in both time and space. These edges can be interpreted as activation wavefronts, which are known to occur shortly before a muscle contracts.



$$Ax = y$$

Reconstructing such wavefronts instead of potential distributions means a reduction of dimensions. This makes the imaging problem less ill-posed. In approaches by van Oosterom and Huiskamp wavefronts of intracellular action potentials (TMVs) have been reconstructed. This thesis will focus on imaging wavefront-based models of TMVs in line with an approach that has recently been published by Brooks for epicardial potentials (EPs).

Tasks

- Implementation of a wavefront-based imaging algorithm
- Performance test on simulated and measured ECG data.

Requirements

- some know-how in signal processing, common sense and creativity
- programming experience in C/C++ or MATLAB
- basic knowledge of Mac OS X/UNIX

Notice

Some knowledge in human physiology is preferred but not required. The project can be performed in English or German.

Field of Research
Inverse problem of ECG
Activation time imaging

Projects
euHeart
DFG / Uniklinik Mannheim

Areas
Signal processing
Algorithmics

Field of Studies
Electrical engineering
Mathematics
Computer science

Starting Date
anytime

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