Karlsruher Institut für Technologie

Institute of Biomedical Engineering

Master Thesis/ Diplomarbeit

„Application of a Kalman Filter with Augmented Measurement Model in Non-Invasive Cardiac Imaging“

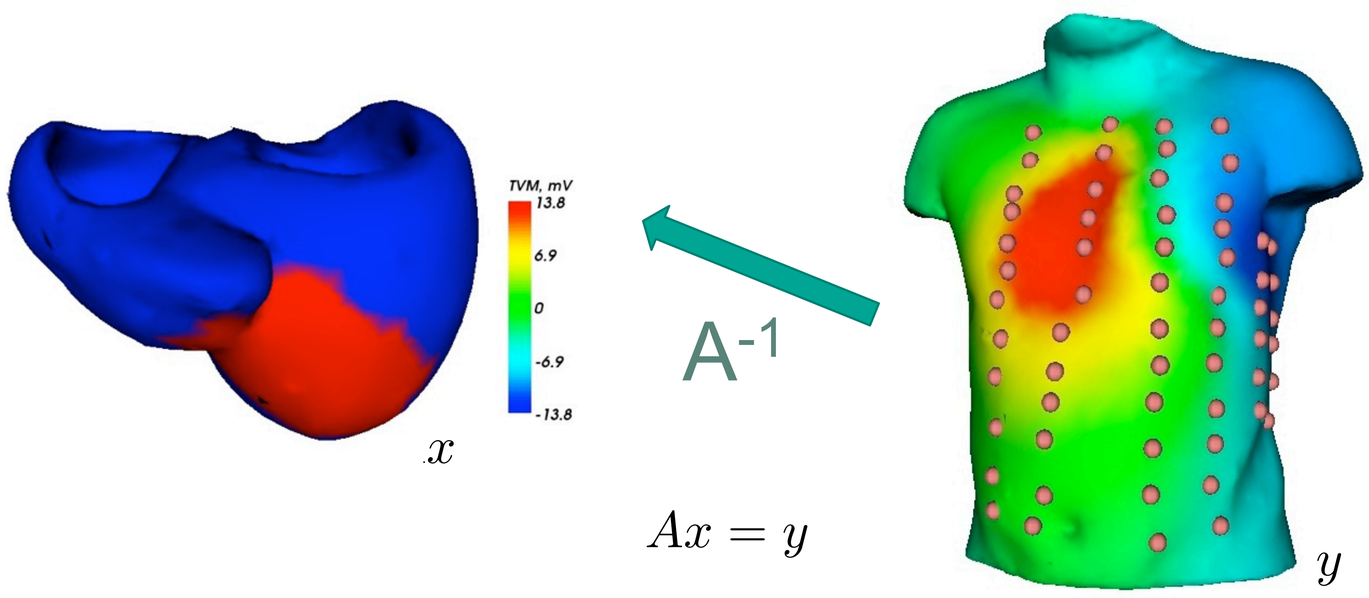
Motivation

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).

Even with such regularization techniques in place, the cardiac source signals obtained with common reconstruction methods are highly unstable. Our aim at IBT is to increase the performance of our methods by using filters that improve the robustness of the solutions.

Recently, we have achieved more stable and precise results in the imaging of transmembrane voltages (TMVs) in the heart with a Kalman filter. The filter combines the reconstructed signals with a prediction that results from a model of their evolution over time.

This work will focus on improving the Kalman filter by use of an extended measurement model (JP Kaipio et al.). This model has been applied in solvers of the inverse problem of electrical impedance tomography, which is a problem that is mathematically very similar to the imaging of electric sources in the heart.



Tasks

- Implementation of a Kalman filter with augmented measurement model
- Performance test on simulated and measured ECG data.

Requirements

- 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
Non-invasive imaging of cardiac electrophysiology

Projects
Inverse Problem Initiative (BECS Helsinki, Chinese University of Hong Kong)
DFG / Uniklinik Mannheim
euHeart

Areas
Signal processing
Algorithmics

Field of Studies
Electrical engineering
Mathematics
Physics
Computer science

Starting Date
anytime

Contact
Dipl.-Ing.
Walther Schulze
Geb. 30.33, Raum 507
Kaiserstr. 12
76131 Karlsruhe

e-Mail:
walther.schulze@kit.edu

phone:
+49 721 608-42751