Providing Anatomical Context for EIT Using Individualized Body Models

Peter Salz
salz@rhrk.uni-kl.de

University of Kaiserslautern
IRTG 1131

Supervisor: Prof. Dr. Hans Hagen

Electrical Impedance Tomography (EIT) is an imaging technique for mechanical ventilation with a low spatial resolution that shows conductivity changes relative to a reference baseline. Its accuracy and quality depend crucially on the body model that is used for image reconstruction. This thesis aims at improving the interpretability of EIT images by providing an individualized body model and anatomical context for image regions. By semi-automatically segmenting 3D Computerized Tomography (CT) scans of a subject, the shape and location of important body structures, such as torso shape, electrode plane, lung, heart, descending aorta, pulmonary arteries as well as pathologically relevant information can be extracted. This extraction process should be interactive, easy and fast, so that a radiologist?s expert knowledge can be taken into account. In order to construct a patient-specific body model, this multi-material segmentation needs to be converted into a 3D tetrahedral finite element mesh.

The EIT image reconstruction using such a model is expected to dramatically improve accuracy, quality, signal-to-noise ratio, expressiveness and therefore also spatial resolution. However, it is still difficult to provide an anatomical context, i.e. relating specific regions in the EIT image to anatomical regions in the body.

Therefore it is necessary to locate certain landmarks both in EIT and CT images that are expected to have a spatial invariance over time, such as heart center and bronchiae. By locating correspondences of those landmarks in both datasets, a spatial transformation can be computed that accommodates the EIT image sequence to the static CT image.

A third part of this thesis deals with automatically interpreting the EIT sequence using the improved reconstruction and anatomical context. This includes detection of certain events such as a pneumothorax or inflation maneuvers as well as evaluation of medical treatment strategies.