Image reconstruction of patient dual-energy computed tomography (DECT) data via DIRA

Knowledge of patient-specific elemental composition of tissues is needed to improve the accuracy of radiation treatment planning. Our research group develops a model-based iterative reconstruction algorithm DIRA, which determines elemental composition of patient tissues from DECT scans. So far, DIRA has been tested on anthropomorphic phantoms only. The aim of this project is to test DIRA on a set of patient data obtained from a Siemens SOMATOM DECT scanner at the Center for Medical Science and Visualization (CMIV) at LiU.

Figure: An example of material decomposition of an anthropomorphic phantom to lipid protein and water bases. DIRA needs testing with measured patient data.

The task:
1. Obtain DECT data sets from the DECT scanner at CMIV. The medical personal at CMIV will help with this task.
2. Convert the data so that they can be processed by DIRA. The conversion software was provided to our research group by Siemens.
3. Evaluate the performance of DIRA by computing elemental tissue compositions of selected tissues. Also, compare the resulting images with images provided by the built-in Siemens software.

Requirements:
The student should be familiar with general principles of computed tomography and interactions of x-rays (10 – 150 keV) with matter. Knowledge of Matlab is needed. The project is suitable for medical physics, biomedical engineering or electrical engineering students.

The work will consist of DECT data acquisition and analysis. The student will learn about DECT. Active approach to problem solving will be encouraged; results will be discussed in a research group. Student's location: the Division of Radiological Sciences, Linköping University.

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Updated: 2014-11-13  www.imh.liu.se/radiologiska-vetenskaper