Development and evaluation of a model-based iterative reconstruction algorithm in dual-energy computed tomography

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What we do

Our research group develops a model-based iterative reconstruction algorithm DIRA.

We focus on radiation therapy (brachytherapy with low-energy photons, proton therapy)
We offer the following projects:

1. Implementation and evaluation of weighted filtered backprojection in DIRA. (Implement WFBP as a C routine in Matlab.)

2. Automatic segmentation of DECT images. (Either extend the JJ2016 algorithm to DECT or, preferably, extend our CNN algorithm based on 3D-UNet)

3. Development of mathematical anthropomorphic phantoms for the validation of DIRA. (Define and use mathematical phantoms in DIRA.)

Other projects may be formulated according to student’s interests.
Examples

The reconstruction algorithm DIRA (3D version)

Automatic segmentation with JJ2016

Mass fraction of lipid, protein and water. 2D mathematical phantom
Selected master’s thesis produced by our students

- Extension of DIRA (Dual-Energy Iterative Algorithm) to 3D Helical CT (2017) Magnus Björnfot
- Automatic Tissue Segmentation of Volumetric CT Data of the Pelvic Region (2017) Julius Jeuthe
- Parallelization of DIRA and CTmod Using OpenMP and OpenCL (2017) Alexander Örtenberg
- Automatic Segmentation of Tissues in CT Images of the Pelvic Region (2014) Martin Kardell
- Three material decomposition in dual energy CT for brachytherapy using the iterative image reconstruction algorithm DIRA: Performance of the method for an anthropomorphic phantom (2013) Robin Westin
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Sources of images used in this presentation