Development of anthropomorphic voxel phantoms for the validation of DIRA

Cancer is a leading cause of death worldwide. Even when treated and cured, cancer patients may still suffer from decreased quality of life. To improve the efficiency of cancer treatment and lower its side effects, researchers in radiation therapy develop more accurate systems for radiation treatment planning. Our group develops a model-based iterative reconstruction (MBIR) algorithm DIRA, which determines elemental composition of patient tissues from dual-energy computed tomography (DECT) scans. Knowledge about the tissue composition allows more accurate computation of spatial distribution of absorbed dose in radiation treatment planning systems. The DIRA algorithm needs testing and validation. The aim of this project is to prepare a set of realistic anthropomorphic phantoms (mimicking for instance the texture of a muscle or trabecular bone) that can be used for testing segmentation and tissue classification routines in DIRA.

The task:
1. Design several anthropomorphic voxel phantoms representing the pelvic region.
2. Adjust the TAKE code so that it can calculate fan-beam x-ray projections of these phantoms.
3. Evaluate the performance of DIRA for these x-ray projections.

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 and C is needed. The project is suitable for medical physics, biomedical engineering or electrical engineering students.

The work will consist of modeling and evaluation of data. 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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