FSH3213 Spectral Computed Tomography 15.0 credits

Spektral datortomografi

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for FSH3213 valid from Spring 2019

Grading scale

P, F

Education cycle

Third cycle

Specific prerequisites

MSc in Engineering Physics or corrsponding.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

After completing the course the student should be proficient both in terms of the fundamentally different methods of spectral CT (Multi-bin vs. Dual-source) and the inherent limitations of different systems. The student should know how the image task affects the optimum in applying material decomposition or energy weighting of the spectral raw data, and be able to explain the pros and cons concerning signal-to-noise ratio, beam hardening and the ability to detect. Student must have good knowledge of the various detector material, and their influence on the final image quality, for different clinically relevant information.

The student should be able to simulate and quantify these effects mathematically. Furthermore, the student should have acquired a good knowledge of the main achievements within spectral CT, in recent years and the research frontier. The student will also be trained to critically review academic manuscripts submitted for peer review.

Course contents

The course content is chosen, in consultation with the examiner, mainly from scientific publications from the journals Medical Physics, and Physics in Medicine and Biology. Among the contents the following is specially mentioned:

Energy weighting:

- Optimal pixel-based weighting in the projection domain
- Optimal pixel-based weighting in the reconstruction domain
- Optimal spatial frequency-based weighting in the projection domain

Material decomposition:

- Underlying assumptions regarding material decomposition as proposed by Alvarez & Macovksi
- Underlying dimensionality of the space of linear attenuation coefficients of human tissue at clinical X-ray energy levels
- Problems with practical implementation of the ML on the forward projection:
    - The effect of low flow rates
    - The effect of uncertain system parameters
- Solution through calibration methods.

Course literature

Computed tomography; principles, design, artifacts and recent advances, Jiang Hsieh, SPIE Press, samt artiklar.

Examination

- INL1 - Assignment, 6.0 credits, grading scale: P, F
- PRO1 - Project, 6.0 credits, grading scale: P, F

- SEM1 - Seminars, 3.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Written examination kombined with oral presentation.

Other requirements for final grade

Grading scale: P/F

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.