HL2012 3D Image Reconstruction in Medicine 6.0 credits

Medicinsk bildrekonstruktion i 3D

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 HL2012 valid from Autumn 2007

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Electrical Engineering

Specific prerequisites

Bachelor's degree in Engineering Physics, Electrical Engineering, Computer Science or equivalent. Basic knowledge of anatomy.

Language of instruction

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

Intended learning outcomes

Three dimensional (3D) imaging plays a central role in medical imaging. 3D images are used for both diagnosis and treatment. For several imaging modalities, data are acquired digitally as one or 2D projections of the object. In order to obtain a 3D image from these projections, a reconstruction operation must be implemented, this course deals with basic methods for digital image processing and commonly used methods for 3D reconstructions. The course is organized as a project course that provides practical knowledge about 3D image reconstruction in medicine. It also provides experience in problem solving as well as presenting research result both orally and in writing.

Upon completion of this course the participant should understand:

- Digital image registration and factors affecting image quality
- Image filtering in space and frequency domains
- Image restoration
- 3D image reconstruction

Course contents

The course includes the following elements:

- An introduction to digital image processing, including digital image filtering both in room and frequency domains, Fourier Transform, Radon Transform, image restoration and registration
- The presentation of Gauss and Poisson noise, the sonogram, Fourier slice theorem
- Different image reconstruction techniques such as the filtered back projection technique, iterative methods, algebraic methods, Maximum Likelihood, ordered subsets as well as a Maximum a Posteriori

In parallel, students will work in small groups with a project aimed as solving a 3D image reconstruction problem and implementing the solution in Matlab code, in addition to writing a report, publishing it on the World Wide Web and presenting it orally for other students and researchers.

The course also includes a seminar work where each (small) group of students reads research articles on a topic in the area of Medical Image Reconstruction, and discusses it orally in a seminar.

Course literature

The course literature consists of current research articles that will be given out when the course starts, in addition to the book:
Gonzalez, Woods & Eddins, Digital Image Processing Using Matlab, Prentice Hall 2004, ISBN 0130085197

Examination

- ANN1 - Exercises, 1.5 credits, grading scale: P, F
- PRO1 - Project, 4.5 credits, grading scale: A, B, C, D, E, FX, 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.

Other requirements for final grade

Passed seminar work (ANN1; 1.5 cr.) grading P/F.
Passed project work (PRO1; 4.5 cr.) grading A-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.