



# HL2027 Medicinsk bildanalys och rekonstruktion i 3D 9,0 hp

3D Image Reconstruction and Analysis in Medicine

## Fastställande

Kursplan för HL2027 gäller från och med VT12

## Betygsskala

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

## Utbildningsnivå

Avancerad nivå

## Huvudområden

Medicinsk teknik

## Särskild behörighet

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

## Undervisningsspråk

Undervisningsspråk anges i kurstillfällesinformationen i kurs- och programkatalogen.

## Lärandemål

Three dimensional (3D) imaging plays a central role in medical imaging. 3D images (which may consist of 2D slices) are used for both diagnosis and treatment. For several imaging modalities, data are acquired digitally as 1D or 2D projections of the object. In order to obtain a 2D or 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 2D and 3D reconstructions. The course also introduces the basic mathematical methods used in the context of medical imaging. The course is organized as a project course that provides practical knowledge about 2D and 3D image reconstruction in medicine. It also provides experience in problem solving as well as assessing and 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
- Image segmentation
- Image classification and analysis
- 2D and 3D image reconstruction

## Kursinnehåll

The course includes the following elements:

- An introduction to digital image processing, including digital image filtering both in room (image space) and frequency domains, Fourier Transform, Radon Transform, image restoration, registration, segmentation, classification and analysis (image understanding).
- The presentation of Gauss and Poisson noise, the sinogram, 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.
- Mathematical methods and theories used in the context of 2D and 3D image processing, reconstruction and analysis.

In parallel, students will work in small groups with projects aimed at solving a 3D image reconstruction problems and implementing the solutions in Matlab code, in addition to writing reports, reviewing and evaluating them as well as presenting and discussing these project works orally for other course participants at seminar sessions.

## Kurslitteratur

The course literature consists of lecture notes as well as 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

- PROA - Projekt, 3,0 hp, betygsskala: A, B, C, D, E, FX, F
- PROB - Projekt, 6,0 hp, betygsskala: A, B, C, D, E, FX, F

Examinator beslutar, baserat på rekommendation från KTH:s handläggare av stöd till studenter med funktionsnedsättning, om eventuell anpassad examination för studenter med dokumenterad, varaktig funktionsnedsättning.

Examinator får medge annan examinationsform vid omexamination av enstaka studenter.

När kurs inte längre ges har student möjlighet att examineras under ytterligare två läsår.

PRO1 - Project works (including reviewing and evaluation) and seminars, 9 credits, grade scale: A, B, C, D, E, F

## Etiskt förhållningssätt

- Vid grupparbete har alla i gruppen ansvar för gruppens arbete.
- Vid examination ska varje student ärligt redovisa hjälp som erhållits och källor som använts.
- Vid muntlig examination ska varje student kunna redogöra för hela uppgiften och hela lösningen.