UNIVERSITY OF GOTHENBURG

INSTITUTE OF NEUROSCIENCE AND PHYSIOLOGY

IA02CF From Image Acquisition to Image Analysis, 5 credits

Från avbildning i mikroskopi till bildanalys, 5 högskolepoäng

Second Cycle

Confirmation

This course syllabus was confirmed by Institute of Neuroscience and Physiology on 2020-02-02 to be valid from 2020-03-09, spring semester of 2020.

Field of education: Science 50% and Medicine 50%
Department: Institute of Neuroscience and Physiology

Position in the educational system

The course is given as a stand-alone course. The course may be part of the master's / master's degree in biomedical laboratory science.

Main field of studies	*Specialization*
Biomedical Laboratory Science	A1N, Second cycle, has only first-cycle course/s as entry requirements

Entry requirements

For admission to the course, the Bachelor's degree is required 180 credits or equivalent in any of the fields of medicine, nursing or natural sciences and English 6.

Learning outcomes

On successful completion of the course the student will be able to:

Knowledge and understanding

- Have an overview of several basic and advanced fluorescence microscopy techniques in biomedical science/research.
- Explain fundamental notions on computerized image analysis, such as digitizing, image enhancement, segmentation and classification of features.

- Describe the proper image acquisition needed for image analysis.
- Describe fundamental notions of Image Ethics: What type of image processing is acceptable for publication and what type is non-acceptable.
- Carry out an image analysis project on a specific problem in the student's own research area.

Competence and skills

- Set up imaging equipment for various applications and understand the limitations of each technology.
- Use software for solving image analysis problems.
- Perform manual and automatic measurements using the freely available image analysis software tools.
- Perform object segmentation, quantification and tracking of using the freely available image analysis software tools.

Judgement and approach

- Set up and use a modern microscope typically found at the bio-labs today: conventional uorescence microscopes and laser scanning confocal microscopes
- Understanding when image analysis can be a solution to a specific problem and when it will probably fail.
- Analyse and outline the steps necessary to solve a realistic image analysis problem in the student's own research area.

Course content

Overview – This is a compact, hands-on from image acquisition to image analysis course. The example material used is mainly fluorescent bio-images, but the underlying concepts taught apply also to images from electron microscopy.

Content – The focus of the course is on reaching a broad understanding of imaging acquisition and computerized image analysis in Life Science and a basic understanding of the theory and algorithms behind the image analysis methods and tools. Hands-on exercises that will teach a broad functionality of these tools and the concepts needed for building suitable workflow for a given application.

This course provides:

- basic concepts in modern fluorescence microscopy: What is fluorescence, different fluorochromes, excitation methods, emission characteristics, purpose and uses
- basic concepts of digital images,
- basic computerized image analysis methods and computer exercises
- image processing in preparation for analysis,
- noise and image enhancement,

- automatically analyzing large datasets.
- We will address the issues of image ethics and proper image acquisition for image analysis.

The course will also offer an introduction to a number of freely available software tools (Image/Fiji),

The course will be conducted in the lecture-hall, the Centre for Cellular Imaging facility and in the computer classroom, one user for each computer. It will consist of both theoretical and practical classes with demos and hands-on at the microscope and analysis of image examples

Form of teaching

The course includes a combination of lectures, seminars and practical sessions

Language of instruction: English

Assessment

The examination will be divided into:

- three computer exercises, both to get familiar with the interfaces of common software and to solve realistic image processing problems
- a project (oral presentation and written report)

Student has the right to change examiner after having failed twice on the same examination, unless special reasons speak against it. (HF 6 Chapter 22 §). Such a request is made to the institution and must be in writing.

In the event that a course has ceased or undergone major changes, the student will normally be guaranteed access to at least three test cases (including the regular test opportunity) for a period of at least one year based on the course's previous presentation. This must not conflict with HF Chapter 6, Section 21.

At least five occasions the students must be offered tests to pass the results of a course or part of a course.

Grades

The grading scale comprises: Pass (G) and Fail (U).

Course evaluation

The course evaluation will be done through a written questionnaire, available at the virtual learning environment, where students are asked to describe their opinions on the

various stages of the course for future development. This information will be compiled and shared with students who participated in the evaluations. Improvements are shared with students participating in the next emission of the course

The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.

Additional information

The course will be given in English.

Kurslitteratur och kursmaterial:

Handouts of the lectures and selected scientific articles will be distributed during the course