



CORE FACILITIES AT SAHLGRENSKA ACADEMY

SC00028, Introductory Course to Image Analysis in Life Science, 2 credits

Introduktionskurs i bildanalys inom Life Science, 2 högskolepoäng

Third-cycle level / Forskarnivå

Confirmation

This syllabus was confirmed by the Council for PhD Education at Sahlgrenska Academy on 2018-12-12, and was last revised on 2026-03-23. The revised course syllabus is valid from Autumn semester 2026.

Responsible Department

Core Facilities at Sahlgrenska Academy, Sahlgrenska Academy

Entry requirements

Admitted to postgraduate education.

The course is an elective course within the third cycle at Sahlgrenska Academy.

Learning outcomes

After completing the course, the PhD student is expected to be able to:

Knowledge and understanding

The aim of the course is to provide students with a solid understanding of modern image analysis.

- Explain fundamental concepts of computerized image analysis, such as digitizing, image enhancement, segmentation and classification of features.
- Describe appropriate image acquisition strategies for image analysis.
- Describe fundamental principles of image ethics, including what types of image processing are acceptable and unacceptable.
- Carry out an image analysis project on a representative light microscopy dataset, demonstrating principles and methods applicable to a wide range of research contexts.

Competence and skills

- Use software to solve image analysis problems.
- Perform manual and automatic measurements using freely available image analysis software tools.
- Perform object segmentation, quantification and tracking using the freely available image analysis software tools.

Judgement and approach

- Critically assess when image analysis can be a solution to a specific problem and when it is likely to fail.
- Analyse and describe the steps necessary to solve a realistic image analysis problem in the student's own research area.

Course content

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

The course focuses on developing a broad understanding of computerized image analysis in the Life Sciences, along with a basic grasp of the underlying theory and algorithms. Through lectures and hands-on exercises, students learn to use common image analysis tools and to design appropriate workflows for specific research applications.

This course provides:

- Basic concepts of digital images
- Introduction to computerized image analysis methods and computer-based exercises
- Visualization of multi-dimensional data
- Image processing and preparation for analysis
- Noise reduction and image enhancement
- Binary operations
- Object/particle analysis and intensity and morphometric measurements
- Tracking of particle and cell movement
- Automated analysis of large datasets
- Discussion of image ethics and proper image acquisition for analysis
- Introduction to freely available software tools (ImageJ/Fiji, Python) to support independent research

The course will consist of both theoretical and practical classes with demos and hands-on analysis of image examples.

Types of instruction

Teaching is provided through lectures and practical sessions. Course materials, including presentations, exercises, and selected scientific articles, are made available via the Canvas course page. Practical components include hands-on exercises using example datasets and relevant software tools.

Language of instruction

The course is given in English

Grades

The grade Pass (G) or Fail (U) is given in this course.

Types of assessment

Attendance of at least 80% of lectures and hands-on sessions is mandatory and required to pass the course. In case of absence from mandatory sessions, the student must complete a substitute assignment according to the course coordinator's instructions.

The examination will be divided into:

- Hands-on image analysis exercises: computer exercises, including image analysis, methodology research and image analysis ethics
- Complete an analysis project, submitting a reproducible program along with the resulting analyses. Teachers evaluate each submission and provide feedback.

If a PhD student, who has been failed on the same examining course component twice, requests a change of examiner before the next examination session, a request of this kind should be sent in writing to the department responsible for the course, and granted, unless there are special reasons to the contrary (Chapter 6, Section 22, Higher Education Ordinance).

Course evaluation

The course evaluation will be provided both as a written questionnaire (joint for Sahlgrenska Academy) and orally as a discussion between the students and the course leader(s). The course responsible teacher compiles analysis of the course evaluation and makes suggestions for further development of the course. The result and any changes in the set-up of the course shall be communicated both to the students that carried out the evaluation and to the students who are about to start the course.