Computer Vision for Video Analysis

Datorseende för videoanalys
6 credits

Programme course

TSBB34

Valid from: 2025 Spring semester

Determined by	**Main field of study**	
Board of Studies for Electrical Engineering, Physics and Mathematics	Computer Science and Engineering, Electrical Engineering	
Date determined	**Course level**	**Progressive specialisation**
2024-08-28	Second cycle	A1N
Revised by	**Disciplinary domain**	
	Technology	
Revision date	**Subject group**	
	Computer Technology	
Offered first time	**Offered for the last time**	
Spring semester 2023		
Department	**Replaced by**	
Institutionen för systemteknik		

Specific information

The course can not be included in a degree together with TSBB15.

Course offered for

- Master of Science in Information Technology
- Master of Science in Computer Science and Software Engineering
- Master of Science in Applied Physics and Electrical Engineering - International
- Master of Science in Computer Science and Engineering
- Master of Science in Applied Physics and Electrical Engineering
- Master of Science in Biomedical Engineering
- Master's Programme in Data Science and Information Engineering

Prerequisites

Probability theory, estimation theory, the least squares method, partial differential equations, 1D & 2D linear system theory (deterministic and stochastic).
Basic image processing: thresholding, segmentation, edge detection.

Use of Python.

As half the course is project work, experience with programming is also recommended.

Intended learning outcomes

The course gives knowledge on the algorithms and estimation problems used to extract information from videos or image sequences. This includes both the mathematics used, and how these are put into practice in algorithm implementation.

After the course, the students should be able to:

Goal 1: *explain* and *use* algorithms for tracking of regions in image sequences

Goal 2: *explain* and *use* algorithms for estimating optical flow

Goal 3: *explain* and *integrate* components for object tracking in image sequences

Goal 4: *explain* and *integrate* components for debugging, visualization, and performance evaluation

Course content

This course teaches methodology related to the goals listed above, with focus on the following:

- Local features and the structure tensor
- Motion estimation and optical flow
- Clustering and background modeling
- Tracking of regions and objects
- Discriminative correlation filters
- Camera surveillance and its ethical/societal aspects

The contents are introduced in a lecture series, and are then put to use in computer exercises and a programming project.

Teaching and working methods

The course consists of a lecture series, lessons, two computer exercises, and a programming project conducted in groups of students. The computer exercises introduce key components of the project and require programming.

Examination

PRA2	Project Work	3 credits	U, 3, 4, 5
LAB1	Laboratory Work	3 credits	U, 3, 4, 5

Attendance is mandatory at the computer exercises, the project presentation seminar, and at the lecture where the project starts.

Goals 1-2 are tested during the computer exercises and Goals 3-4 during the project.

For grade 3, a pass on the project and the computer exercises are required. Demonstrating higher abilities to explain and use methods in the projects or computer exercises results in grade 4, demonstrating higher abilities to explain and use methods in the projects and computer exercises results in grade 5.

Presentation of details of the assessment criteria can be found on the course web page.

Grades for examination modules are decided in accordance with the assessment criteria presented at the start of the course.

Grades

Four-grade scale, LiU, U, 3, 4, 5

Other information

Supplementary courses:

3D Computer Vision, Images and Graphics, Project Course CDIO, Machine learning for computer vision, Thesis

About teaching and examination language

The teaching language is presented in the Overview tab for each course. The examination language relates to the teaching language as follows:

- If teaching language is “Swedish”, the course as a whole could be given in Swedish, or partly in English. Examination language is Swedish, but parts of the examination can be in English.
- If teaching language is “English”, the course as a whole is taught in English. Examination language is English.
- If teaching language is “Swedish/English”, the course as a whole will be taught in English if students without prior knowledge of the Swedish language participate. Examination language is Swedish or English depending on teaching language.

Other

The course is conducted in such a way that there are equal opportunities with regard to sex, transgender identity or expression, ethnicity, religion or other belief, disability, sexual orientation and age.

The planning and implementation of a course should correspond to the course syllabus. The course evaluation should therefore be conducted with the course syllabus as a starting point.

The course is campus-based at the location specified for the course, unless otherwise stated under “Teaching and working methods”. Please note, in a campus-based course occasional remote sessions could be included.