GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2021-2022

Computer Vision (E736020)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

Course size *(nominal values; actual values may depend on programme)*

Credits 6.0	**Study time 180 h**	**Contact hrs** 72.0 h

Course offerings and teaching methods in academic year 2021-2022

A (semester 2)	Dutch	Gent	group work	48.0 h
			lecture	24.0 h

Lecturers in academic year 2021-2022

Veelaert, Peter	TW07	lecturer-in-charge

Offered in the following programmes in 2021-2022	crdts	offering
Master of Science in Electrical Engineering Technology (main subject Automation)	6	A
Master of Science in Electrical Engineering Technology (main subject Electrical Engineering)	6	A
Master of Science in Electronics and ICT Engineering Technology (main subject Embedded Systems)	6	A
Master of Science in Electronics and ICT Engineering Technology (main subject ICT)	6	A
Master of Science in Information Engineering Technology	6	A

Teaching languages

Dutch

Keywords

computer vision, machine learning

Position of the course

The course examines a number of modern, commonly used techniques in image processing and computer vision such as facial recognition, recognition of pedestrians and cyclists, the use of intelligent cameras for surveillance tasks. The emphasis is on designing original algorithms and acquiring the programming skills necessary for the implementation of complex algorithms. The programming environment used is Python with OpenCV and PyTorch.

Contents

1 Overview of basic computer vision problems: motion analysis, 3D modeling and scene reconstruction, segmentation of scenes and objects
2 Imagie formation: homogeneous coordinates, 2D and 3D transformations, pinhole camera model, projection matrices and epipolar geometry
3 Image Segmentation: Hough Transform and RANSAC Algorithm
4 Common features detectors: SIFT, Fast, Brief, ORB and HoG
5 Image Registration and Structure from Motion
6 Classification and performance measures: confusion matrices, ROC curves, F1 scores
7 Texture analysis: Gabor filters, co-occurrence matrices, local binary patterns
8 Simple classifiers: k-Nearest Neighbor, Naïve Bayes, LDA, QDA
9 Support vector machines
10 Boosting: AdaBoost with examples (face detection)
11 Bagging: Random forest classifiers and decision trees
12 Object recognition and image segmentation with neural networks: Yolo, Faster R-CNN, encoder-decoder networks

Initial competences

Fluent programming in Python or C ++ and a basic knowledge of algorithms and data structures

Final competences

1 To design innovative algorithms for computer vision
2 To formally describe and evaluate an algorithm
3 To have an overview of the basic techniques for camera calibration, image segmentation and object recognition

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Group work, lecture

Extra information on the teaching methods

This is mainly a project oriented course. The students work in groups of 4 to 5 students on a challenging computer vision problem. In the theoretical part an overview is given of the most important techniques from computer vision. These techniques are illustrated and applied in a number of introductory lab sessions intended as preparation for the project.

Learning materials and price

slides and tutorials on Ufora

References

Course content-related study coaching

Evaluation methods

end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period

Examination methods in case of periodic evaluation during the second examination period

Examination methods in case of permanent evaluation

Portfolio, assignment

Possibilities of retake in case of permanent evaluation

not applicable

Extra information on the examination methods

At the end of the project, the following must be submitted:
1 report for introductory lab sessions
2 software code of the project
3 article of 10-12 pages in English and in Latex describing the project.
The project will be defended at a final presentation, with a live demo and the results of the test benches. Students who obtained a fail mark during the first examination period, can individually resubmit a number of assignments during the second examination period (own work package, own part of the presentation).

Calculation of the examination mark

Project assessment (per group):
- scientific approach and originality (10%),
- oral defense project (10%),
- self-written article (10%).

Assessment per student:
- questions about the theory (30%),
- questions about literature study (10%),
- questions about project (10%),
- solutions lab problems (20%).