LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Datorseende
Computer Vision

FMAN95, 7,5 credits, A (Second Cycle)

Valid for: 2021/22
Faculty: Faculty of Engineering, LTH
Decided by: PLED F/Pi
Date of Decision: 2021-04-23

General Information

Main field: Virtual Reality and Augmented Reality.
Compulsory for: MVAR1
Elective for: BME4, C4, D4-bg, D4-mai, E4-bg, F4, F4-bg, F4-mai, Pi4-bam, MMSR1
Language of instruction: The course will be given in English on demand

Aim

The aim of the course is to give an overview of the theory of and practically useful methods in computer vision, with applications within e.g. vision systems, non-invasive measurements and augmented reality. In addition the aim is to make the student develop his or her ability in problem solving, with and without a computer, using mathematical tools taken from many areas of the mathematical sciences, in particular geometry, matrix theory, algebraic geometry, optimization, mathematical statistics, invariant theory and transform theory.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to clearly explain and use basic concepts in computer vision, in particular regarding projective geometry, camera modelling, epipolar geometry, stereo vision and structure and motion problems for static and dynamic scenes.
- be able to describe and give an informal explanation of the mathematical theory behind some central algorithms in computer vision (the least squares method, robust model fitting, RANSAC, singular value decomposition, convex optimization and Newton based optimization).

Competences and skills
For a passing grade the student must

- in an engineering manner be able to use computer packages to independently solve problems in computer vision.
- be able to show good ability to independently identify problems which can be solved with methods from computer vision, and be able to choose an appropriate method.
- be able to independently apply basic methods in computer vision to problems which are relevant in industrial applications or research.
- with proper terminology, in a well-structured way and with clear logic, be able to explain the solution to a problem in computer vision.

Contents

Projective geometry. Geometric transformations. Modelling of cameras. Camera calibration. Epipolar geometry. Stereo vision. Photogrammetry. Model fitting. Robust metrics. Minimal solvers. 3D-modelling. Geometry of surfaces and their silhouettes. Deformable models. Visualisation.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Compulsory assignments comprising both theory and computer work. Approved results on all these is enough to pass the course. To get a higher grade it is necessary to pass a written and an oral test

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Assumed prior knowledge: FMAF05 Systems and Transforms, or equivalent (for example FMAF10).
The number of participants is limited to: 140
Selection: Incoming qualified exchange students have priority to 10 places. The ranking among such applicants is performed by the course coordinator based on relevant courses taken. Among the remaining applicants priority is given according to the number of completed university credits within the program. Priority is given to students enrolled on programmes that include the course in their curriculum. Among such students priority is given to students in the Master's Programme in Virtual Reality and Augmented Reality (MVAR), for whom the course is compulsory.
The course overlaps following course/s: FMAN85, FMA270, FMA271

Reading list

- Image group: 2015. Lecture notes available on the web.

Contact and other information

Course coordinator: Studierektor Anders Holst, Studierektor@math.lth.se
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Course administrator: Studerandeexpeditionen, expedition@math.lth.se
Course homepage: http://www.maths.lth.se/course/datorseendenynykod/