

# FMAN95 COMPUTER VISION (7.5hp)

## Period 3, 2022

**Lecturer:** Carl Olsson, tel. 046-222 85 65, email [carl.olsson@math.lth.se](mailto:carl.olsson@math.lth.se), room MH:435.

**Lectures:** Carl Olsson

Tuesday 8–10 (study week 1–8)

Wednesday 10–12 (study weeks 1–7).

Thursday 10–12 (study week 1).

Due to a large number of registered participants the initial lectures will be on zoom (see the canvas page for a link). Depending on how many people attend the lectures we may switch back to regular lectures, in the room MH:Gårdingsalen, assuming that it is possible to maintain safe distances (see the canvas page for up-to-date information).

**Q&A-sessions:** Ivar Persson, Niels Christian Overgaard & Carl Olsson

Tuesday 15–17 (study weeks 2-7).

Q&A-sessions will be online in zoom. Link will be available from the course homepage.

**Assignments:** There are four mandatory assignments. They contain both exercises that should be solved by hand and computer exercises. You can get help with these (and work with them) during the Q&A-sessions. See last page for more details on assignment rules.

**Course Literature:**

Lecture notes will be available from the course homepage. (In addition a few scientific papers might be used during the lectures.)

**Course homepage:** <https://canvas.education.lu.se/courses/15096>

**Registration:** Use Studentportalen. Re-registrations cannot be done through Studentportalen but has to be done manually by the administrators. Other problems with registration are also handled by the administrators (send an email to [expedition@math.lth.se](mailto:expedition@math.lth.se)).

**Project:** It is possible to extend the course with 3 additional credits by doing a project in applied mathematics (FMAN40). A list of possible projects will be available at the course homepage. It is also possible to suggest your own ideas for projects.

**Examination:** Grade 3 (pass) requires that all home assignments have been handed in and been approved. To achieve a higher grade (4 or 5) you also need to complete the take-home-exam and the oral exam.

**Student Reception:**

The student reception of Mathematics LTH is located on the fifth floor (room MH:540) in the mathematics building, but is currently closed due to the corona virus. The course administrators are Jessica Kareseit, tel. 046–222 91 86, and Hanne Nordqvist, tel. 046–222 49 30, email [expedition@math.lth.se](mailto:expedition@math.lth.se).

## Preliminary plan for lectures (L), assignments (A) and Q&A-sessions (Q&A).

The following is a suggested work plan for the course, which includes when to solve the mandatory exercises in the assignments. You will find the exercises (E) and computer exercises (CE) in each assignment on the home page. It is of course up to you if you want to follow the suggested plan or not as long as you make the deadlines. However, in order not to fall behind I strongly suggest that you do not deviate too much from it. Note that the amount of work varies between assignments. Assignment 1 is much faster than the rest, so don't delay too long with these.

18/1	L 1	zoom-meeting	... Course information, Introduction, The pinhole camera
19/1	L 2	zoom-meeting	..... Homogeneous coordinates and projective geometry
	A 1	on your own	..... From Assignment 1: E1,CE1,E2,E3,CE2,E5,CE4.
20/1	L 3	zoom-meeting	..... Affine Cameras, 1D-cameras
	A 1	on your own	..... From Assignment 1: E4,CE3.
25/1	L 4	zoom-meeting	..... Camera calibration, DLT, SVD
	A 2	on your own	..... From Assignment 2: E1,CE1,E2,E3,E4,E5,CE2
25/1	Q&A 1	zoom-meeting	..... Questions on Assignment 1 & 2
26/1	L 5	zoom-meeting	..... Triangulation, Homographies
	A 2	on your own	..... From Assignment 2: E7,CE3,CE4,CE5
30/1	D 1		<b>Assignment 1 deadline this week.</b>
1/2	L 6	MH:Gårding*	..... Radial distortion
1/2	Q&A 2	zoom-meeting	..... Questions on Assignment 2
2/2	L 7	MH:Gårding*	..... Epipolar geometry, The fundamental matrix
	A 3	on your own	..... From Assignment 3: E1,E2,E3,CE1
8/2	L 8	MH:Gårding*	..... Cameras from F, Upgrades
	A 3	on your own	..... From Assignment 3: E4,CE2
8/2	Q&A 3	zoom-meeting	..... Questions on Assignment 2 & 3
9/2	L 9	MH:Gårding*	..... The essential matrix, Sequential Reconstruction
	A 3	on your own	..... From Assignment 3: CE3, E6, CE4
13/2	D 2		<b>Assignment 2 deadline this week.</b>
15/2	L 10	MH:Gårding*	..... Model fitting
15/2	Q&A 4	zoom-meeting	..... Questions on assignment 3
16/2	L 11	MH:Gårding*	..... RANSAC, minimal solvers
	A 4	on your own	..... From Assignment 4: E1,E2,CE1,CE2
22/2	L 12	MH:Gårding*	..... Reconstruction and optimization
	A 4	on your own	..... From Assignment 4: CE3,CE4
22/2	Q&A 5	zoom-meeting	..... Questions on assignment 3 & 4
23/2	L 13	MH:Gårding*	..... Global optimization in SfM.
27/2	D 3		<b>Assignment 3 deadline this week.</b>
1/3	L 14	MH:Gårding*	..... Subspace learning, Factorization and SfM.
	A 4	on your own	..... From Assignment 4: E4,CE5
1/3	Q&A 6	zoom-meeting	..... Questions on assignment 4
2/3	L 15	MH:Gårding*	..... Stereo and Surfaces. Photometric Stereo.
8/3	L 16	MH:Gårding*	..... Project introductions. Repetition.
13/3	D 4		<b>Assignment 4 deadline this week.</b>

\*Assuming that distances can be maintained otherwise it will be a zoom-meeting. See the canvas page for up-to-date information.

**General Assignment rules:**

Deadlines are firm and reports are to be handed in on time through the canvas page. The reports should be written individually, however you are encouraged to work together. Keep in mind that everyone is responsible for their own report and should be able to explain all the solutions. (Exactly what should be submitted is stated in the assignment instructions.) Not everything has to be correct the first time you hand in however you have to present solutions/attempts for each mandatory exercise. It is not ok to hand in blank solutions. (If you have problems solving something you should come to the Q & A-sessions or contact the lecturer by email in good time before the deadline.) In exceptional cases extensions can be offered (due to unforeseen circumstances). In such cases contact the lecturer by email before the deadline (or as soon as possible) for instructions on what to do.

After solutions have been handed in the assignment will be corrected and you will receive feedback on what needs to be improved. You then submit a revised version of your solutions. Make proper revisions, partial or minimal corrections that results in continued iteration of the revision process will not be accepted. We do not have a strict limit on the number of revisions that you can make, but cases with no/minimal improvements will be not be corrected or approved. (If you have problems come to the Q & A-sessions or contact the lecturer.) **The final deadline for getting all the assignments approved (after revisions) is April 1.** Assignments not approved by this time can be resubmitted in the exam period in August.

The assignments contain some optional exercises. You do not have to do these to pass. However if you submit good solutions to these you can be awarded bonus points for the home exam. From all four assignments you can get at most 1 bonus point in total. (The home exam has 6 tasks worth 1 point each and the final grade is the total score, counting bonus from the assignments, rounded down to 4 or 5. Scores below 4 give final grade 3 if all the assignments are approved.) The bonus is determined from the first submission of the report. That is, if you do not get the full bonus after the first submission you will not be able to improve it through revisions (however you can still get feedback). No bonus points will be awarded for solutions handed in after the deadline.