

Vision Algorithms for Mobile Robotics

Instructor: [Prof. Dr. Davide Scaramuzza](#)

Rooms:

- **Lectures:** every Thursday from 10:15 to 12:00 in **ETH LFW C5**, Universitätstrasse 2, 8092 Zurich
- **Exercises:** Thursdays (check out course schedule), from 13:15 to 15:00 in **ETH HG E 1.1**, Rämistrasse 101, 8092 Zurich

Course website: <http://rpg.ifi.uzh.ch/teaching.html>

Course Schedule (tentative) – Exercises are marked in **gray**

Date	Time	Description of the lecture/exercise	Lecturer
21.09.2017	10:15 - 12:00	01 – Introduction	Davide Scaramuzza
28.09.2017	10:15 - 12:00	02 - Image Formation 1: perspective projection and camera models	Guillermo Gallego
05.10.2017	10:15 - 12:00	03 - Image Formation 2: camera calibration algorithms	Davide Scaramuzza
	13:15 – 15:00	Exercise 1: Augmented reality wireframe cube	T. Cieslewski/H. Rebecq/A. Loquercio
12.10.2017	10:15 - 12:00	04 - Filtering & Edge detection	Davide Scaramuzza
	13:15 – 15:00	Exercise 2: PnP problem	T. Cieslewski/H. Rebecq/A. Loquercio
19.10.2017	10:15 - 12:00	05 - Point Feature Detectors 1: Harris detector	Davide Scaramuzza
	13:15 – 15:00	Exercise 3: Harris detector + descriptor + matching	T. Cieslewski/H. Rebecq/A. Loquercio
26.10.2017	10:15 - 12:00	06 - Point Feature Detectors 2: SIFT, BRIEF, BRISK	Davide Scaramuzza
02.11.2017	10:15 - 12:00	07 - Multiple-view geometry 1	Guillermo Gallego
	13:15 – 15:00	Exercise 4: Stereo vision: rectification, epipolar matching, disparity, triangulation	T. Cieslewski/H. Rebecq/A. Loquercio
09.11.2017	10:15 - 12:00	08 - Multiple-view geometry 2	Davide Scaramuzza
	13:15 – 15:00	Exercise 5: Eight-point algorithm and RANSAC	T. Cieslewski/H. Rebecq/A. Loquercio
16.11.2017	10:15 - 12:00	09 - Multiple-view geometry 3	Davide Scaramuzza
	13:15 – 15:00	Exercise 6: P3P algorithm and RANSAC	T. Cieslewski/H. Rebecq/A. Loquercio
23.11.2017	10:15 - 12:00	10 - Dense 3D Reconstruction (Multi-view Stereo)	Davide Scaramuzza
	13:15 – 15:00	Exercise 7: Intermediate VO Integration	T. Cieslewski/H. Rebecq/A. Loquercio
30.11.2017	10:15 - 12:00	11 - Optical Flow and Tracking (Lucas-Kanade)	Davide Scaramuzza
	13:15 – 15:00	Exercise 8: Lucas-Kanade tracker	T. Cieslewski/H. Rebecq/A. Loquercio
07.12.2017	10:15 - 12:00	12 – Place recognition	Davide Scaramuzza
	13:15 – 15:00	Exercise 9: Recognition with Bag of Words	T. Cieslewski/H. Rebecq/A. Loquercio
14.12.2017	10:15 - 12:00	13 – Visual inertial fusion	Davide Scaramuzza
	13:15 – 15:00	Exercise 10: Pose graph optimization and Bundle adjustment	T. Cieslewski/H. Rebecq/A. Loquercio
21.12.2017	10:15 - 12:00	14 - Event based vision + lab visit and live demonstrations	Davide Scaramuzza
	13:15 – 15:00	Exercise 11: final VO integration	T. Cieslewski/H. Rebecq/A. Loquercio

Exercises:

You will be required to bring **your own laptop** to the exercise session. You will need to have **Matlab** already pre-installed in your machine for the exercise.

- ETH: Download from <https://idesnx.ethz.ch/>
- UZH: Download from http://www.id.uzh.ch/dl/sw/angebote_4.html; Info on how to setup the license can be found there.

Please install all the toolboxes included in the license.

Recommended textbooks:

- Robotics, Vision and Control: Fundamental Algorithms, by Peter Corke 2011. The PDF of the book can be freely downloaded from Springer (only with ETH VPN) or alternatively from [Library Genesys](#)
- Computer Vision: Algorithms and Applications: R. Szeliski - <http://szeliski.org/Book/>
- An Invitation to 3D Vision: Y. Ma, S. Soatto, J. Kosecka, S.S. Sastry
- Multiple view Geometry: R. Hartley and A. Zisserman

Mini Projects

- Optional but if handed it and working properly can give up to 0.5 grade increase
- More instructions will come soon

Grading

- Oral exam (30 minutes)