Vision Algorithms for Mobile Robotics

Instructor: Prof. Dr. Davide Scaramuzza (when away, replaced by Dr. Guillermo Gallego)
Teaching Assistants: Antonio Loquercio & Mathias Gehrig
Office times: Every Thursday 15:30 to 17:30 (please announce yourself by email first)

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
20.09.2018	10:15 - 12:00	01 – Introduction	Davide Scaramuzza
27.09.2018	10:15 - 12:00	02 - Image Formation 1: perspective projection and camera models	Davide Scaramuzza
	13:15 – 15:00	Exercise 1: Augmented reality wireframe cube	Titus Cieslewski & Mathias Gehrig
04.10.2018	10:15 - 12:00	03 - Image Formation 2: camera calibration algorithms	Guillermo Gallego
	13:15 – 15:00	Exercise 2: PnP problem	Antonio Loquercio & Mathias Gehrig
11.10.2018	10:15 - 12:00	04 - Filtering & Edge detection	Davide Scaramuzza
18.10.2018	10:15 - 12:00	05 - Point Feature Detectors 1: Harris detector	Guillermo Gallego
	13:15 – 15:00	Exercise 3: Harris detector + descriptor + matching	Antonio Loquercio & Mathias Gehrig
25.10.2018	10:15 - 12:00	06 - Point Feature Detectors 2: SIFT, BRIEF, BRISK	Davide Scaramuzza
	13:15 – 15:00	Exercise 4: SIFT detector + descriptor + matching	Antonio Loquercio & Mathias Gehrig
01.11.2018	10:15 - 12:00	07 - Multiple-view geometry 1	Guillermo Gallego
	13:15 – 15:00	Exercise 5: Stereo vision: rectification, epipolar matching, disparity, triangulation	Antonio Loquercio & Mathias Gehrig
08.11.2018	10:15 - 12:00	08 - Multiple-view geometry 2	Davide Scaramuzza
	13:15 – 15:00	Exercise 6: Eight-Point algorithm	Antonio Loquercio & Mathias Gehrig
15.11.2018	10:15 - 12:00	09 - Multiple-view geometry 3	Davide Scaramuzza
	13:15 – 15:00	Exercise 7: P3P algorithm and RANSAC	Antonio Loquercio & Mathias Gehrig
22.11.2018	10:15 - 12:00	10 - Dense 3D Reconstruction (Multi-view Stereo)	Davide Scaramuzza
	13:15 – 15:00	Exercise session: Intermediate VO Integration	Antonio Loquercio & Mathias Gehrig
29.11.2018	10:15 - 12:00	11 - Optical Flow and Tracking (Lucas-Kanade)	Davide Scaramuzza
	13:15 – 15:00	Exercise 8: Lucas-Kanade tracker	Antonio Loquercio & Mathias Gehrig
06.12.2018	10:15 - 12:00	12 – Place recognition	Davide Scaramuzza
	13:15 – 15:00	Exercise session: Deep Learning Tutorial	Antonio Loquercio
13.12.2018	10:15 - 12:00	13 – Visual inertial fusion	Davide Scaramuzza
	13:15 – 15:00	Exercise 9: Bundle adjustment	Antonio Loquercio & Mathias Gehrig
20.12.2018	10:15 - 12:00	14 - Event based vision	Davide Scaramuzza
	12:30 – 13:30	**Scaramuzza's lab visit and live demonstrations**: Andreasstrasse 15, 2.11, 8050	Davide Scaramuzza & his lab
	14:00 – 16:00	Exercise session: final VO integration (it will take place close to Scaramuzza's lab)	Antonio Loquercio & Mathias Gehrig

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 (Library Genesys)

Mini Projects

- Optional but if handed it and working properly can give up to 0.5 grade increase
- Instructions will be provided during the course.

Grading: Oral exam (30 minutes)