

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 14:15 to 16:00 in **ETH HG E 33.1**, Rämistrasse 101, 8092 Zurich

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

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

Date	Time	Description of the lecture/exercise	Lecturer
22.09.2016	10:15 - 12:00	01 – Introduction	Scaramuzza
29.09.2016	10:15 - 12:00	02 - Image Formation 1: perspective projection and camera models	Scaramuzza
06.10.2016	10:15 - 12:00 14:15 – 16:00	03 - Image Formation 2: camera calibration algorithms Lab Exercise 1: Augmented reality wireframe cube	Scaramuzza Titus Cieslewski/Henri Rebecq
13.10.2016	10:15 - 12:00 14:15 – 16:00	04 - Filtering & Edge detection Lab Exercise 2: PnP problem	Scaramuzza Titus Cieslewski/Henri Rebecq
20.10.2016	10:15 - 12:00 14:15 – 16:00	05 - Point Feature Detectors 1: Harris detector Lab Exercise 3: Harris detector + descriptor + matching	Scaramuzza Titus Cieslewski/Henri Rebecq
27.10.2016	10:15 - 12:00	06 - Point Feature Detectors 2: SIFT, BRIEF, BRISK	Scaramuzza
3.11.2016	10:15 - 12:00 14:15 – 16:00	07 - Multiple-view geometry 1 Lab Exercise 4: Stereo vision: rectification, epipolar matching, disparity, triangulation	Scaramuzza Titus Cieslewski/Henri Rebecq
10.11.2016	10:15 - 12:00 14:15 – 16:00	08 - Multiple-view geometry 2 Exercise 5: Eight-point algorithm and RANSAC	Scaramuzza Titus Cieslewski/Henri Rebecq
17.11.2016	10:15 - 12:00 14:15 – 16:00	09 - Multiple-view geometry 3 Exercise 6: P3P algorithm and RANSAC	Scaramuzza Titus Cieslewski/Henri Rebecq
24.11.2016	10:15 - 12:00 14:15 – 16:00	10 - Dense 3D Reconstruction (Multi-view Stereo) Exercise 7: Intermediate VO Integration	Scaramuzza Titus Cieslewski/Henri Rebecq
01.12.2016	10:15 - 12:00 14:15 – 16:00	11 - Optical Flow and Tracking (Lucas-Kanade) Exercise 8: Lucas-Kanade tracker	Scaramuzza Titus Cieslewski/Henri Rebecq
08.12.2016	10:15 - 12:00 14:15 – 16:00	12 – Place recognition Exercise 9: Recognition with Bag of Words	Scaramuzza Titus Cieslewski/Henri Rebecq
15.12.2016	10:15 - 12:00 14:15 – 16:00	13 – Visual inertial fusion Exercise 10: Pose graph optimization and Bundle adjustment	Scaramuzza Titus Cieslewski/Henri Rebecq
22.12.2016	10:15 - 12:00 14:15 – 16:00	14 - Event based vision + lab visit and live demonstrations Exercise 11: final VO integration	Scaramuzza Titus Cieslewski/Henri Rebecq

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 here: <http://www.s3it.uzh.ch/software/matlab/>

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 Genesis](#)
- 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

- Mandatory
- More instructions will come soon

Grading

- Mini project: **30%**

- Oral exam (30 minutes): **70%**