Objectives: The aim of the course is to present image processing and computer vision techniques for 3D static and dynamic scene interpretation, object recognition and robot motion guidance.

Contents

Introduction to computer vision for robotics applications

Part 1 - image processing fundamentals
- Digital image fundamentals: sensing and acquisition, sampling and quantization, basic operations
- Lab: digital image and basic operations
- Intensity transformations and spatial filtering (filtering in the frequency domain)
- Edge and corner detection
- Lab: edge and corner detection
- Color image processing
- Lab: color-based segmentation
- Hough transforms and image segmentation
- Early vision: feature detection and regularization. Optimal filters and multichannel representations (Gabor functions)

Part 2 - motion analysis and navigation
- Motion: 3D and 2D motion fields, dense and sparse optical flow. Dominant motion estimation
- Lab: optical flow
- Tracking with linear dynamic models (Kalman Filter)
- Autonomous navigation

Part 3 - geometry
- 3D computer vision fundamentals
- The geometry of image formation: review of projective geometry (basic), projective transformations, camera models and single view geometry, camera calibration
- Stereopsis: epipolar geometry, stereo rectification, depth estimation, 3D reconstruction
- Lab: epipolar geometry

**Conclusions:** introduction to object and action recognition methods in HRI

**Abilities:**

After completing this course the students will:
- have a working knowledge of the main computer vision algorithms
- be able to select computer vision algorithms for specific purposes
- have an understanding of main problems of robot vision and will have the basis for solving such problems.

**Propedeuticità:**

**Exam:**

30% continuous assessment through practical laboratory exercises done throughout the semester, 70% from end-semester exam. The final exam consists in a two-hour written examination. It is not allowed to consult books, notes, or other written material.

**Contacts**

By appointment: francesca.odone@unige.it, fabio.solari@unige.it

**Recommended texts:**

Recommended texts:

Further readings: Material distributed by lecturers

**Dati statistici relativi alle votazioni d’esame conseguite dagli studenti:**