UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Introduction To Digital Imaging and Computer Vision

2526-2-F1702Q013

Aims

To give a basic and robust understanding of digital image processing and computer vision.

Contents

Introduction to digital image formation, digital image processing, and 3D reconstruction by stereoscopy.

Detailed program

1. Image formation
    - Pin-hole model;
    - Spatial and intensity sampling;
    - Sampling theorem (very short review);
    - The need for optics;
    - Defects introduced by optics;
    - Defects introduced by sensor;
    - Colour cameras (bayer, 3-sensors, stacked).
2. A realistic pin-hole projection model
3. Calibration of the projection model
4. Image processing and enhancement
    - Point operators: linear and non-linear;
    - Spatial filtering;
    - Introduction to denoising algorithms;
    - Notes on image registration;

    - Simple local feature detection: point-based, statistics.
5. Image segmentation
    - Segmentation based on local features;
    - Notes on advanced denoising algorithms.
6. Model-based vision (just mentioning)
7. Point-based stereometry
    - Basic terminology;
    - Triangulation and stereo-matching;
    - Stereomatching algorithms (e.g., correlation).
8. Examples of applications of the previous concepts in optics, optometry, ophthalmology

Prerequisites

Linear 3D geometry (lines, planes), linear algebra.

Teaching form

Classes and practices, both programming and hands-on.

Textbook and teaching resource

Selected parts from well-known textbooks like, e.g.,

- David A. Forsyth and Jean Ponce, "Computer Vision: A Modern Approach" 2nd edition, Pearson, 2012
- Emanuele Trucco, Alessandro Verri, "Introductory techniques for 3D Computer Vision", Prentice Hall, 1998
- Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing" 3rd edition, Pearson, 2007

Semester

1st semester

Assessment method

Oral exam

Office hours

Please, send an email to arrange an appointment.

Sustainable Development Goals