

## COURSE SYLLABUS

### Introduction To Digital Imaging and Computer Vision

2526-2-F1702Q013

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#### 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**

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