DRIEI
PhD Program in Electronic and Computer Engineering
University of Cagliari, Italy

Course:	Introductory seminar on Computer Vision
Instructor:	Sara Concas
SSD:	ING-INF/05 INFORMATION PROCESSING SYSTEMS
Credits / hours:	1.5 credits / 15 hours
Language:	English
Scheduling:	II semester (2-6 September 2024)
Final Exam:	Written
Website:	https://github.com/SaraConcasUnica/Introductory-seminar-on-Computer-Vision

Goal of the Course

The aim of the course is to provide participants with basic theoretical knowledge of the methods of Computer Vision and an introduction to the main application areas. The course will be based on practical demonstrations and exercises to involve participants and at the same time increase their skills on the topics covered.

Prerequisites

Adequate knowledge of Python programming language. In addition, basic theoretical knowledge of image processing, algebra (vectors, matrices, etc.), and machine learning techniques.

Intersection with other courses at the University of Cagliari

The seminar has some intersections with the “Artificial Intelligence”, the “Biometric technologies and behavioral security”, and the “Machine Learning” courses provided for the Master’s Degree Course of Computer Engineering, Cybersecurity, And Artificial Intelligence.

Course Outline

- Introduction to Computer Vision (3h)
    - AI and ML recalls
    - Digital images recalls
    - Exercise (open, visualize, image properties) Numpy + OpenCv
    - What is Computer vision
    - Practical examples
- Image/Video classification and retrieval (3h)
    - Image classification
    - Supervised vs Unsupervised

    - Binary vs. Multi-label classification
    - Video classification
- Semantic segmentation (3h)
    - Definition
    - Semantic segmentation with SVMs
    - Semantic segmentation with Random Forests
    - Semantic segmentation with DL methods
- Object detection (3h)
    - Object Detection vs semantic segmentation
    - Object detection (viola-jones, histogram of oriented gradients, CNNs)
    - Practical examples (face detection)
    - Alignment
    - Practical examples (generic object alignment + face alignment)
    - Classification (handcrafted features, holistic methods, CNNs)
- Single and multi-object tracking (3h)
    - Definition
    - Image tracking and video tracking
    - Single and multi-object tracking
    - Algorithms
    - Challenges