Introduction

IMAGE PROCESSING AND COMPUTER VISION – PART 2

SAMUELE SALTI

Course structure

Prof. Giuseppe Lisanti (First Part)

- Image formation and acquisition process
- Spatial Filtering
- Edge detection
- Local Invariant Features
- Object Detection

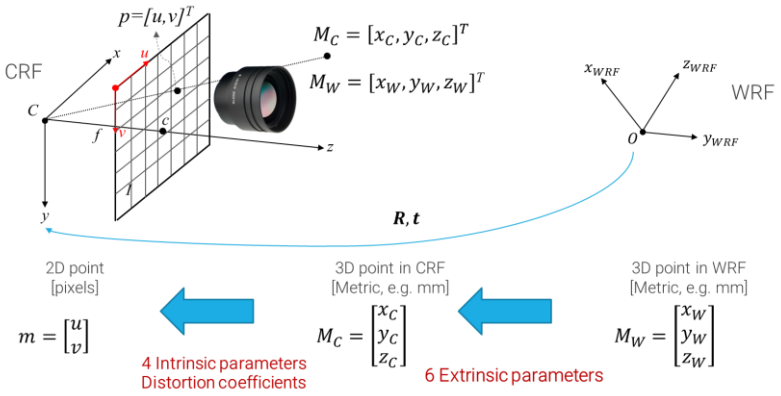
- OpenCV + spatial filtering/edge Laboratory
- Local Invariant Features Laboratory

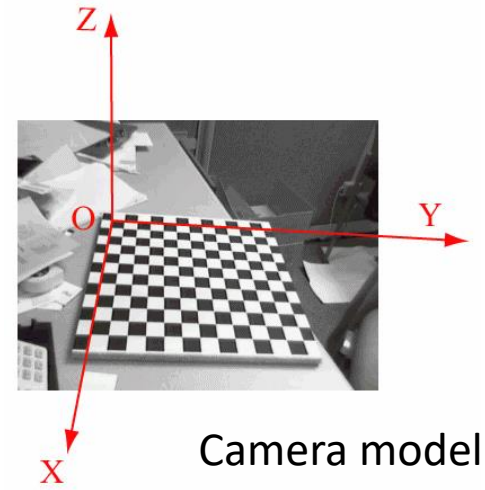
Prof. Samuele Salti (This Part)

- Camera Model and Calibration
- Image classification
- Convolutional Neural Networks
- Successful architectures
- Training recipes

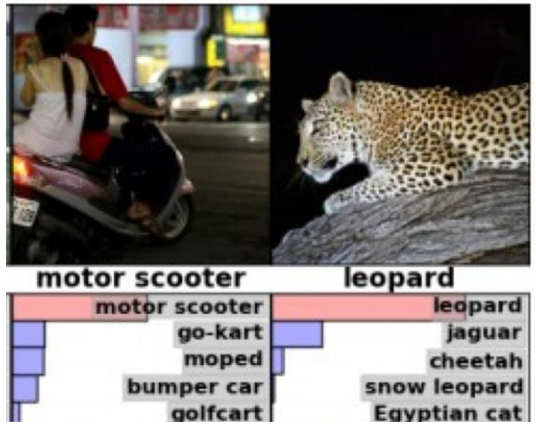
- Lab session on Camera Calibration
- Lab session on PyTorch and CNNs
- Lab session on Transfer learning

This module - Foundations





Camera model and camera calibration



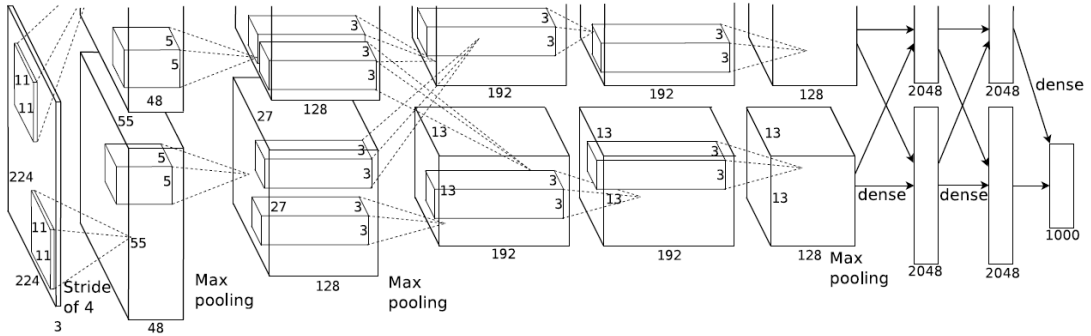
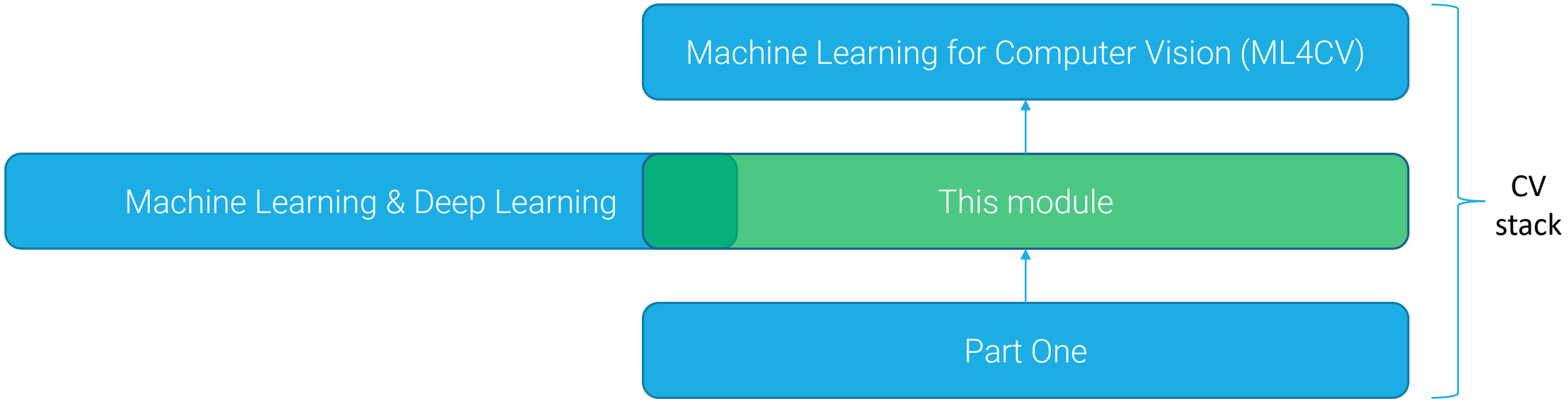
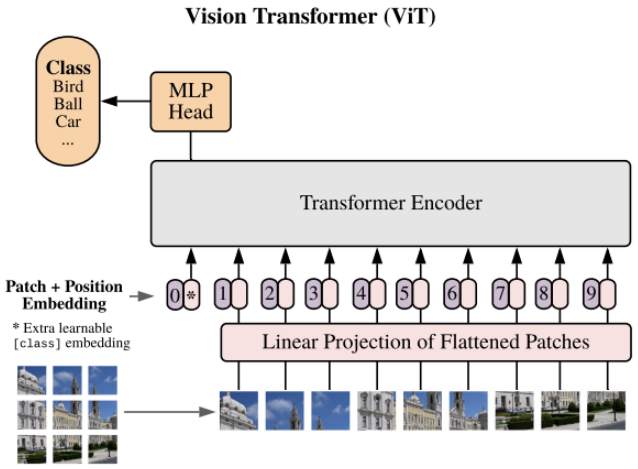


Image classification – shallow ML and CNNs

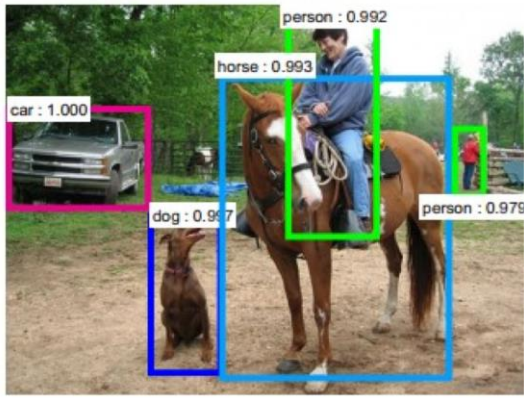
Relationship with other courses



Machine Learning for Computer Vision (ML4CV)

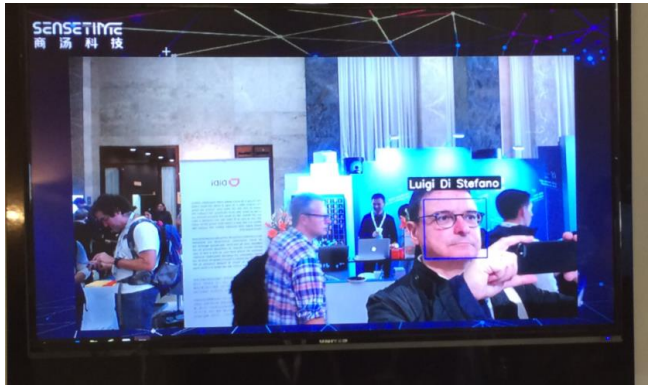


Vision Transformers



Object detection

Semantic and instance segmentation



Metric learning

A photo of a Corgi dog riding a bike in Times Square. It is wearing sunglasses and a beach hat.

Text-guided Image generation with diffusion models

Course logistics

Lessons: I'd like to start at 11:15 on Mondays and 11:00 on Thursdays. And then have a 15 minutes break midway. We will normally use only two hours on Thursdays, but when we have lab sessions you can stay until 14.

Textbooks: there is no official textbook. Some suggestions available on-line on the course web-page. In particular,

- image formation model and (partially) camera calibration are covered in chapters 2-4-6-7 of the Multi View Geometry book by Richard Hartley and Andrew Zisserman
- the image classification part is partially covered by chapters 4 to 8 of Dive into Deep Learning book.

Exam (1/3)

The exam consists in two parts:

1. a written exam in which the student will answer two questions on the course content (max grade 24, min grade 15). An example will be available on Virtuale.

   The grade for the written exam can be rejected by the student only once.
   The student must communicate that they do not accept the grade within 5 days from checking the errors. The accepted grade is valid for three years.

Four exam dates:

- 25th June 2025
- 17th July 2025
- 8th September 2025
- …yet to be defined by the AI degree…will be in January or February 2026

Exam (2/3)

2. A practical part consisting of two assignments, one for each part of the course (max grade 7)

- The assignment MUST be completed in groups of 2 (maximum 3) students - you form the groups. Assignment completed by one student alone will not be reviewed and will receive 0 points. Exceptions for working students.
- The assignments can be submitted *only once, it cannot be resubmitted*.
- If the assignment is not submitted in the current academic year, you will have to carry out the assignment for the new academic year.
- There are cut-off dates to upload the assignments on Virtuale (defined according to scholarship deadlines and final exams): 15/07/25 (for ERGO scholarship in August), 01/09/2025, 27/10/2025, 22/12/2025, 16/02/2025. They will appear on Virtuale in the coming days
- Double check the submission, it must be in the “submitted” state, not in “draft to submit”

Exam (3/3)

3. One bonus point will be given if the exam is completed in the academic year of enrolment (only for student enrolled in the current academic year, i.e., AA 2024/2025)