# Vision and Cognitive Systems

## A.Y. 2022/2023

## Written Exam - February 21, 2023

# Exam Instructions

- Write your *name* and *Stud.ID (matricola)* on **every** page.

- You have just one page (one side) to answer a question.

- You will have **exactly** 90 min to complete your exam.

# Question 1 (2 points)

Describe in detail a bag-of-visual-words model by highlighting all the main steps of computation and the major "design choices"/parameters. Then you should briefly introduce spatial pyramids and motivate their advantages with respect to a standard pipeline.

# Question 2 (3 points)

Describe in detail the SIFT algorithm; you should present both detection and description stages, and illustrate the classical SIFT matching approach (aka Lowe's 2NN ratio test).

## Question 3 (3 points)

Describe in detail a CNN architecture, introducing the most important components (layers, activation functions, etc.) and pros/cons with respect to a traditional neural network.

## Question 4 (2 points)

Please provide i) a clear definition of the convolutional operator, ii) its main properties and iii) report the kernel matrix of a filter that will produce as an output an image that is shifted by 2 pixels in the left direction.