Vision and Perception
Exam B

20 July 2023

Name, Surname, Student ID [please compile here]:

The exam has to be carried out in 1 hour and 40 minutes.
In order to pass the exam you need to get 18 and a minimum of 8 points in each of the two parts. The exam consists in 6 exercises.
Write the answers for the two respective parts on two separate sheets.

1 Part 1

- **Exercise 1** Given an image Im and a filter f_1, shows the intermediate passages and the the resulting image g after applying the correlation operator between Im and f_1. Use the following coordinates (2,2), (3,1), (4,2) with "zero" padding. [4 points]

$$Im = \begin{bmatrix} 2 & 2 & 1 & 0 \\ 0 & 6 & 2 & 1 \\ 4 & 0 & 1 & 2 \\ 7 & 1 & 0 & 2 \end{bmatrix} \qquad f_1 = \begin{bmatrix} 0 & 3 & 0 \\ 1 & 0 & 2 \\ 2 & 1 & 2 \end{bmatrix}$$

- **Exercise 2.** Describe the Canny edge detector. What are the steps involved in edge detection using this detector? [6 points]

- **Exercise 3.** Explain how the Fourier Transform is used for image enhancement by applying frequency domain filters, such as high-pass filter. What information about the shape and orientation of an object can be inferred, and how, from the Fourier Transform operation applied to an image? [6 points]

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2 Part 2

- **Exercise 4.** Describe the main pipeline to build a Structure from Motion system given a set of pictures showing a building from different views, highlighting the task characteristics and the quantities that can be estimated. [6 points]

- **Exercise 5.** Explain what is the process called *camera calibration.* Which quantities can be recovered with it? Show in general terms an algorithm that performs camera calibration. Which data is required to run it? *it is not required to show the full equations which give the final results; the starting equation and the final result will be sufficient to fully answer this question.* [6 points]

- **Exercise 6** Explain the dropout technique. Why it can be beneficial to deep model training? [4 points]