

First Laboratory Work

I. PATTERN RECOGNITION - EXPLORATION OF THE VISUAL INFORMATION IN IMAGES CONTAINING STILL OBJECTS

The goal of the first laboratory work is to *visually* explore the contents of the images containing still objects. The images whose processing is expected to be developed by the students are contained in the directory "MATERIAL/database". Some samples of these images are shown in Figure 1. These images were acquired, placed on a table with a homogeneous and clear surface. The camera is mounted on a tripe adjusted so that the plane of the sensor is parallel to the plane of the table.

In this work it is expected that the students **will explore the contents of the images, providing visual information regarding its contents**. Although several questions are asked (see below), these questions do not prohibit exploratory development. Also note that, when asked for some feature (*e.g.*, area, distance), this should be answered using **to visual information**.

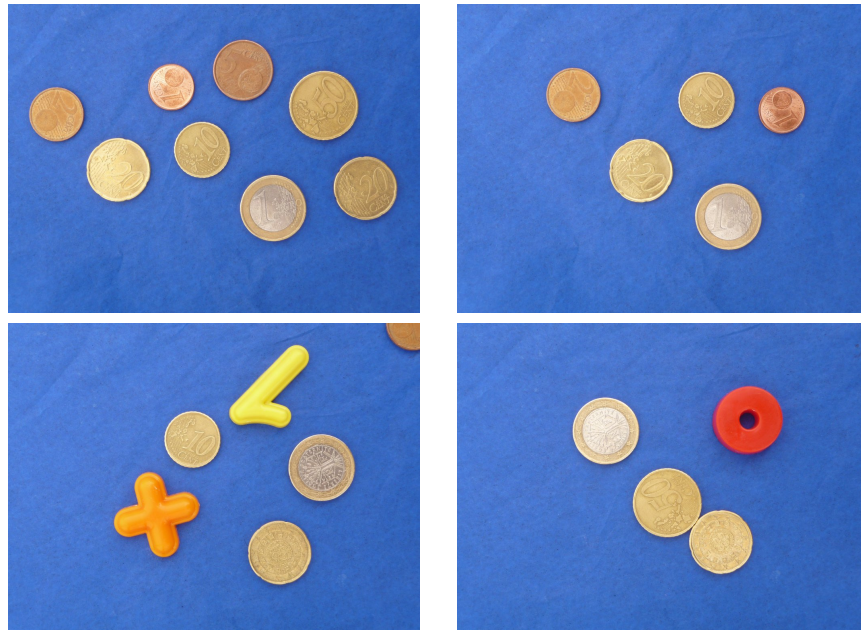


Figure 1. Four images with blue background containing some foreground objects with different shape and colors.

From the above, the following issues must be taken into consideration: (i) besides the suggestions provided to explore the visual contents of the images (see questions below), the students may find new ways to provide such visual information, and (ii) for each question visual cues should be provided.

Interesting image properties to be explored can be:

- 1) [1.5 v] Counting the number of objects.
- 2) [1.5 v] Visualization of the centroid of the objects.
- 3) [1.5 v] Visualization of the perimeter of the objects.
- 4) [1.5 v] Area of the objects.
- 5) [1.5 v] Sharpness (contour derivative) of the objects.



- 6) [1.5 v] The information asked in the previous items could be ordered, for instance, creating new figure when the objects are ordered from larger are to smaller area.
- 7) [1.5 v] Compute a geometrical transformation of one (or more) objects in the image. The output result should be visualised in a new image.
- 8) [2.0 v] Another important cue is to explore the “visualisation by interaction”. Thus, given an object selected by the user, it is possible to provide. the information in 2), 3), 4), 5), 6) and 7) in relation to the selected object. For instance, from the selected object, it is possible to generate a new figure where it is shown the most similar object to the least similar object. Also, and taking the item 7), it is possible to the user to select the object, and then visualize (in a new image) the transformed version of the selected object.
- 9) [1.5 v] From the previous item, compute the heatmap from the selection performed. For instance, the user selects an object, and from its centroid, it is possible to generate a color distribution, where the hot color is placed at the centroid of the selected object and cold color is placed at farther distances of the object.
- 10) [1.5] Generalize the previous question when several objects are selected.
- 11) [2.0 v] Compute the quantity of money presented in the image.
- 12) [0.5] Discuss how it could be possible to detect head or tails of a coin.
- 13) [2.0 v] The developed software should be prepared to receive new test images, so that the teacher can include a new code line containing the path. localization of the new test images. This last item intends to evaluate the work in new (unseen) test images. Notice however, that the test images are acquired in same conditions as the training images shown in Figure 1.

Final Remark: The students must be send a zip code to the following e-mail: `jan@isr.tecnico.ulisboa.pt`. The deadline is on May 9th, at 23h59m.