Exercises Computer Vision
28/10/2021

Exercise 1:

The Laplacian of a Gaussian h, (LoG) is:

$$\nabla^2 h(r) = -\left[\frac{r^2 - \sigma^2}{\sigma^4}\right] e^{\frac{r^2}{2\sigma^2}}$$

where $r^2 = x^2 + y^2$ and σ is the standard deviation.

Questions:

1. Why the result of applying the filter LoG and after the zero crossing, always returns closed contours?
2. Explain why the Sobel filter obtains wider contours than the zero crossing filter.
3. Let us going to compare two different methods over the same image. The first one is to apply only the LoG filter; the second one is to apply a median filter and after the Laplacian. Have the two methods the same result? Reason the answer of this question.

Exercise 2:

A company wants to develop a software method to detect water bottles (Fig.1 shows these bottles). The method requires to segment the bottles and extract some features. Note: Use Matlab functions to answer at least the questions 1 and 2.

Questions:

1. Given Fig.1 (the name of the file in ATENEA is Fig_Bottles), extract the contour using the following functions: Laplacian, Roberts and Sobel detectors. Extract also the contours using a morphological operator. ¿Which of them obtain the contours with only a pixel and eliminating the noisy points?
2. For each one of the bottle contours, obtain the following features: perimeter, area, compacity, position of the bottles and orientation of the bottles.
3. Using the features of point 2, can you identify univocally each one of the bottles?

Fig.1

Exercise 3:

Given the Fig.2 and Fig.3, which are the computer vision operations required to pass from the image of Fig.2 to Fig.3?

0	0	0	70	70	70	0	0	70	70	0	0
0	0	0	70	70	70	0	0	70	70	0	0
0	0	0	70	70	70	0	0	70	70	0	0
0	0	50	20	20	20	50	0	0	0	0	0
0	50	20	20	20	40	20	50	0	0	0	0
0	50	20	20	40	20	20	50	0	0	0	0
0	50	20	40	20	20	20	50	0	0	0	0
0	50	40	20	20	20	20	50	0	0	0	0
0	0	50	20	20	20	50	0	0	0	0	0
0	50	20	20	20	20	20	50	0	0	0	0
0	50	50	50	50	50	50	50	0	0	0	0

Fig.2

0	0	1	1	1	1	0	0	0	0	0	0
0	0	1	0	0	1	0	0	0	0	0	0
0	1	1	0	0	1	0	0	0	0	0	0
0	1	0	0	0	0	1	0	0	0	0	0
1	1	0	0	0	0	1	1	0	0	0	0
1	0	0	0	0	0	0	1	0	0	0	0
1	1	0	0	0	0	1	1	0	0	0	0
0	1	0	0	0	0	1	0	0	0	0	0
0	1	0	0	0	0	1	0	0	0	0	0
0	1	1	0	0	1	1	0	0	0	0	0
0	0	1	1	1	1	0	0	0	0	0	0

Fig.3