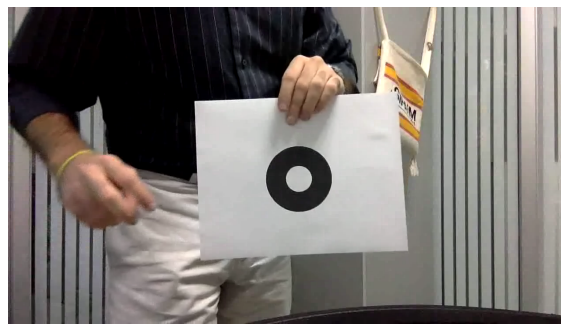


This assignment is to be carried out individually in Matlab and you have to deliver the code, with results and calculations in a single PDF file. You have to show the results in class.

Nombre y apellidos: _____

Exercises

1. The task for today is to detect a contrasting concentric circle (CCC) target in a sequence of images from the video “oneCCC.mp4” on the course website. The target is a black ring surrounding a white dot. This feature is fairly unique in the image, because the centroid of the black ring will be very close to the centroid of the white dot. You should be able to detect the target in each image of the sequence, with no false detections.



Following the slides on the course website titled “Reading & writing movies in Matlab”, write a program that reads and displays each image of the video. Next, write code to threshold each image. As described in the lecture slides, local thresholding is more robust to intensity variations across the image, but for this scene, global thresholding works fine (i.e., Matlab’s `graythresh` function).

Next, write code to compare the centroids of all the white regions with the centroids of all the black regions, and test whether they are closer than a threshold distance (you will have to experiment with the threshold). Draw a crosshair (or rectangle) at those locations.

You may find the following functions useful.

- `W=im2bw(I,graythresh(I))` – to threshold the image to binary
- `W = imopen(W,S)` – to eliminate small (noise) regions.
- `[LW,numWhite] = bwlabel(W)` – to perform connected component labeling
- `statsWhite = regionprops(LW)` – to compute region properties such as the centroid

To compute the distance between two centroids, you can use `norm(statsWhite(i).Centroid - statsBlack(j).Centroid)`

As described in the lecture, you may need to apply some additional tests on the candidate targets to eliminate false detections. You can use some or all of these:

- The area of the black ring must be greater than the area of the white dot.
- The black bounding box must enclose the white bounding box.
- The “circularity” ratio of the outer region must be greater than some threshold. The circularity ratio is $R = 4 * \pi * \text{area} / (\text{perimeter}^2)$. R is 1 for a circle, and $\pi/4$ for a square.