

EECS 442 Computer Vision, Fall 2016 Homework 4

Due on Tuesday, November 29, 2016 at 11:59pm.

Please submit your assignment on Canvas. Format PDF.

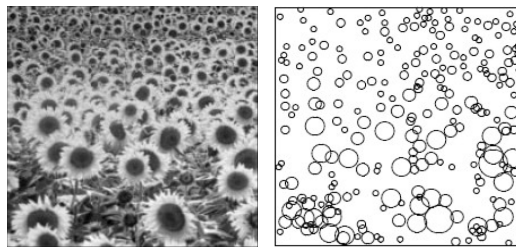
Put your name on the top of the first page or it will not be graded!

1 [55 points] Harris Corner Detection

In this problem, you will be using the images *I1.png* and *I3.png*.

- (a) [20 points] Implement the Harris corner detector by computing the second moment matrix M at each pixel location. Choose an appropriate value for the size of the window W . Refer to the class notes for the notation. Return the source code of your implementation. Clearly indicate the key steps of the algorithm as well as the choice of parameters in the source code.
- (b) [20 points] Compute the eigenvalues of M at every pixel locations. Compute the ellipses associated to such eigenvalues as discussed in the class notes or in FP page 184. Superimpose such ellipses on the two images similarly to Figure 8.17 or 8.18 in FP. Repeat this step by using different sizes of the window W . Return zoomed details of images I1 and I3 with superimposed ellipses for different values of the window size. Comments your results.
- (c) [15 points] Use the corner response R to assess whether a corner has been detected or not. Superimpose corners with $R > T$ on the two images. Explore a few different values of T . Return the images I1 and I3 with superimposed corners for different values of T . Comments your results.

2 [45 points] Blob Detection



- (a) [30 points] [*Blob Detector*] Implement a blob detector based on the Laplacian operator and characteristic scale concept introduced by Lindeberg.
 - (1) Apply your blob detector to the image *3.bmp*.
 - (2) Plot each blob as a circle with radius given by the scale-space analysis (e.g., see figure above). Use a Threshold T to suppress blob responses. Report your choice of T and comment on its value.
Note: Use MATLAB function `show_all_circles.m` to plot the circles.
- (b) [15 points] [*Description*] Compute the radius of each blob (in pixels) and report the histogram (distribution) of radii computed for the whole image. Show numerical values. Normalize radii from 0 to 1 before plotting histogram. Use 10 bins in your histogram. Use Threshold $T = 1500$.