CS6550 Computer Vision

Homework # 1: Feature Extraction

Due: 11:59pm, 10/20/2014

I. (40%) Perform the following steps sequentially to the two images below for edge detection. Write each of the following steps as a separate function and show the step-by-step results.

a. Perform the Gaussian smoothing of different scales (σ =1, 5). Show the results using kernel of size 11-by-11. (4 images)

b. Apply the Sobel masks to the above Gaussian smoothed images and compute the magnitude of gradient images. (4 images)

c. Perform non-maximal suppression with appropriate gradient thresholding for edge detection. (4 images)

II. (50%) Detect the corners of the above two images by using the Harris corner detector. Perform the following step-by-step procedure:

a. Use the Sobel gradient images of two different scales from problem I.b to compute the structure tensor of a pixel **H**. Show the images of the smaller eigenvalue of **H** for window size 3-by-3 and 5-by-5, respectively. (8 images)

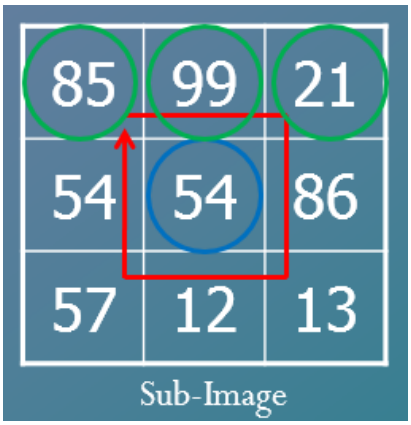
b. Compute the corner response function **R** (k = 0.04) at all pixels and show the results for the two scales and window sizes. (8 images)

c. Perform non-maximal suppression on the results from II.a and II.b along with appropriate thresholding for corner detection. Please discuss the results. (16 images)

d. Apply the Harris corner detection implemented by corner response function **R** to the rotated and zoomed versions of the two images. (16 images) (please refer to the files in the **hw1_2e** folder)

e. Try to compare the consistency of the detected corners on the triples of images (original, rotated and zoomed). Discuss the results.

III. (10%) Implement the LBP feature vector, in its original form, using (8,1) neighborhood on the above 2 images. For a sub-image, the thresholding order on the 8 neighbors should be the same as the sub-image below. Show the results of LBP image and the histogram of LBP. (4 images)



Reminder:

1. You are allowed to use these Matlab functions: **fspecial**, **imfilter**, **cov2**
   You are not allowed to use these Matlab functions: **gradient**, **edge**, **corner**.
2. Your package should contain a README file about your execution instruction. Your code should display and output your results so that we can judge if your code works from the results alone. Please be sure to name each images and files according each problem index.
3. Please compress your codes, result images and report in the file named HW1_{Student-ID}.zip and upload it to iLMS before 10/20(Mon.) 23:59:59.