Problem-set-1

1. Consider the filter f=[1, 2, 1] and the 1D image I=[0,1,2,3,3,3,1,3,6]. What is the results of f*I? Pad the image with zeros at the boundaries if necessary. (10 points)

2. Name two specific ways in which one could reduce the amount of fine, detailed edges that are detected with the Canny edge detector. (10 points)

3. Hybrid images. In this problem you will create hybrid images as described in [1]. Take two images, A and B, that you' ll want to have blend from one to the other. Try to make the objects in the two images occupy more or less the same region. Construct a hybrid image from A (to be seen close-up) and B (to be seen far away) as follows:

   out = blur(B) + (A-blur(A))

   Where blur is a function that low-pass filters the image. You can write your own blur function, or use the upBlur and blurDn functions supplied in [2] (which go up and down. Gaussian pyramid levels). You will want to blur by more than just one Gaussian pyramid level. How does the blurring level affect your perception of the results?

   Submit your images, results and code. (40 points)

4. Read the book chapter chapter-local-image-feature-David.pdf (find it in canvas) and complete the following programing exercises. (40 points)

   (1) Build a Harris corner detector; for each corner, estimate scale and orientation. Now test how well your list of neighborhoods behaves under rotation, translation, and scale of the image. You can do this by a simple exercise in matching. For each test image, prepare a rotated, translated, and scaled version of that image. Now you know where each neighborhood should appear in the new version of the image — check how often something of the right size and orientation appears in the right place. You should find that rotation and translation cause no significant problems, but large scale changes can be an issue. (20 points)
   (2) Use DoG detector in SIFT to detect the interesting points for the same test image, and compare the results with Harris corner detector on the variances of rotation, translation and scaling. (20 points)

References

[1] Aude Oliva, Antonio Torralba, and Philippe G Schyns. Hybrid images. ACM Transactions on Graphics (TOG), 2006. http://cvcl.mit.edu/publications/OlivaTorralb_Hybrid_Siggraph06.pdf.

[2] Eero Simoncelli. matlabPyrTools. http://www.cns.nyu.edu/~eero/software.php.