

1. (5) **Corner detector.** In this problem you will use Matlab implementation of the Harris corner detector which you can download from http://cs.gmu.edu/~kosecka/cs685/code/harris_corners.m. Alternatively you can use OpenCV implementation. Your task is to run this corner detector on two sample images provided in <http://cs.gmu.edu/~kosecka/code/>, namely `house1.jpg` and `house1-rotated.jpg` visualize the results and answer some questions below. Here is a set of Matlab commands demonstrating its use.

```
>> im = rgb2gray(imread('house1.jpg'));
>> corners = harris_corners(im,7,1.5);
>> imshow(img);hold on;
>> plot(corners(:,1),corners(:,2),'r+')
```

- (a) For fixed parameter values, run the detector on `house1.jpg` and `house1-rotated.jpg`. The latter image is a rotated copy of the former. If we rotate the input image, do the detected corner positions rotate by the same amount ? Justify your answer based on your observations.
- (b) If we scale down the input image, are all the detected corner positions scaled accordingly ? You can test this experimentally by comparing the corner detection on the images `house1.jpg`, `house1-2down.jpg`, `house1-4down.jpg`. Each image in this sequence is half the size of its predecessor. Justify your answer based on your observations.

Harris Point Correspondences. Use the Harris corner code from the previous exercise, select the features in the first image and find the corresponding points in the second image. Carry out the experiments on the stereo pair of images of the images of the `house1.jpg` and `house2.jpg` (both available in the same directory) Implement the correspondence using SSD (sum-of-squared-differences) similarity measure.

Submit the code (of SSD experiment), the image with the overlayed result of the feature detector and the image pair with corresponding points in two views (to visualize the result make a new image putting the two images side-by-side and connect the corresponding features by plotting lines originating in one view and finishing in another.

2. **SIFT Correspondences** Use the SIFT detector code from <http://www.vlfeat.org> or OpenCV version. Use the image files from the previous exercise, Detect the features in the a) `house1.jpg` and `house2.jpg` and run the matching algorithm; b) `house1.jpg` and `house1-rotated.jpg`; c) `house1.jpg` and `house1-2down.jpg` and `house1-4down.jpg`.

For this exercise you simply have to run the demo described in the following tutorial <http://www.vlfeat.org/overview/sift.html> and answer following two questions.

- (a) Describe in words the algorithm for matching the descriptors (also described in the original SIFT paper).
- (b) Comment on the differences in the performance