

ECE 661: Homework 4

September 20, 2012

Due: October 2, 2012 (Tuesday) before the class

Problem:

The goal of this homework is to learn about extracting “interest-points” from images and using simple comparisons to establish correspondences between the interest points extracted from two different images of the same scene.

An interest point is basically a point in an image that is distinguished in some sense. Simplest possible interest points are corners that are typically extracted with the Harris corner detector. More “elaborate” interest points that stand out as you examine an image at different scales are those that are extracted by scale-space operators like SIFT and SURF.

This homework calls upon you to create your own implementation for the Harris corner detector and to use the existing OpenCV or MATLAB implementations for either the SIFT or the SURF operator.

This homework requires you to apply these interest point extractors to a pair of images that are available at http://web.ics.purdue.edu/~kim497/ece661/homework/ECE661_2012_hw4_images.zip. Subsequently, compare each interest point extracted from one image with every interest point in the other image. For the Harris corner detector, use the SSD and NCC metrics applied to windows around the interest points to establish the similarity between the interest points. For SIFT and SURF, you can directly compare their descriptor vectors. Show your correspondences with the help of lines as you see displayed in Figure 1. [SSD stands for “Sum of Squared Differences” and NCC stands for “Normalized Cross Correlation”. These will be covered in class.]

You must also show results on at least one pair of images recorded with your own camera.

The narrative in your homework submission should comment on the quality of the correspondences obtained with Harris, on the one hand, and SIFT or

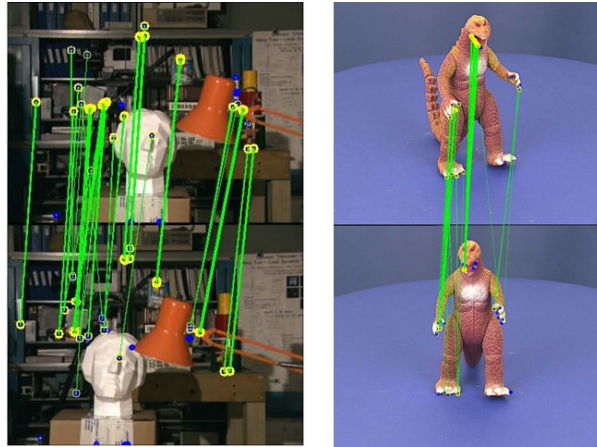


Figure 1: Example results

SURF, on the other.

You are encouraged to use the OpenCV library to do your homework but you may not use the built-in function `cornerHarris` for the Harris corner detector. On the other hand, you may use the built-in function for the SIFT and SURF. If you are a MATLAB user, you can also use the built-in function in the VLFeat open source library at <http://www.vlfeat.org/>.

Submission of Your Work:

You should turn in a report in pdf format of your homework solution using the blackboard. The report should include

1. A brief outline of two feature extraction algorithms such as Harris corner detector and either SIFT or SURF including the relevant equations.
2. A brief description of how you did the feature matching for SSD, NCC, and the descriptor vector.
3. A description and illustration with parameters chosen for your best feature extraction and matching, respectively.
4. Your source code along with comments.

You are permitted to look at sample solutions from previous semesters. However, the work you turn in must be your own as the typed report!