Introduction

In your writeup, described the steps you completed for each problem and show the results. Readability will be part of your grade.

*Do not use all two weeks to accomplish this assignment! The final will be released on Tuesday, November 23, 2010*

1 Implement the Harris Corner Detector

As discussed in class, the Harris Corner Detector operates on the auto-correlation matrix, which can be described as

$$A = w \ast \begin{bmatrix} I_x^2 & I_x I_y \\ I_x I_y & I_y^2 \end{bmatrix}$$

Using this matrix, the feature points, or good points to match are found by computing the value

$$H = det(A) - \alpha \text{trace}(A)^2$$

with If,

$$A = \begin{bmatrix} a & b \\ b & c \end{bmatrix}$$

then, $det(A) = ac - b^2$ and $trace(A) = a + c$.

For this problem, use one of the provided images to find the best 20 points for matching using the points with the highest value of $H$. Note that to implement this, you need to

1. Compute the image derivatives
2. Compute images representing $I_x^2$, $I_y^2$, and $I_x I_y$.
3. Smooth each of these with a kernel, $w$.
4. Compute $H$

2 Matching

Next, we will experiment with matching. In one of the two images provided, we’ll call it Image 1, identify ten points that you will match – you can use your code from the previous problem or you can hand-identify points. Next, for each point, hand-identify the matching point in Image 2.

Now, create a descriptor(see below) for each of the twenty points in Image 1 and all points in Image 2. Using these descriptors, find the closest point in Image 2 that corresponds to image 1. What is the mean distance between the right answer and the chosen point?

You should try two different types of descriptors:
1. Just use a $5 \times 5$ patch of pixels.

2. Use a descriptor that is a collection of derivative response values, similar to the descriptor used in the midterm.