| ECE 172a | Machine Vision | Pamela Cosman | 3/8/12 |

HOMEWORK 6
Due Friday, March 16 by start of class

The image coke.tif is a fairly clean image of a Coke can. The image tran.tif is a version that has been subjected to a pure translation, with no other corruption of the image.

1. Write a routine that implements the Fourier phase correlation method for finding translation parameters. After you inverse transform, you can find the maximum of the array (named out) by using

   ```
   [i,j] = find(out == max(max(out)))
   ```

   Use your routine to register the Coke image to itself. Does the array that comes from the inverse transform look like a perfect discrete delta? You can see what it looks like using matlab's *mesh* command. Report and explain your results.

2. Now use the routine to register the Coke image to the tran image. Again, report and explain your results, and comment on whether or not (and why) the array looks like a perfect discrete delta. Try it both ways: registering coke to tran, and registering tran to coke. What is the best registration?

3. Now we will briefly look at whether this method can handle noise. If the image is scaled between 0 and 255, say, then you can add a significant component of random noise to the translated image as follows:

   ```
   noisy = tran + 40 * randn(425,227);
   ```

   (Check to see that your image is scaled 0 to 255, because if it is scaled between 0 and 1, this would be rather too much noise.) Use your routine to register the Coke image and the noisy image. Discuss the results.

4. Now, try blurring the translated image:

```
filt = hamming(9) * hamming(9)'
filt = filt / sum(sum(filt));
blurred = filter2(filt,tran);
```

Use your routine to register the Coke image and the blurred image, and discuss the results.

5. This time, we will both blur it and add noise:

```
realbad = blurred + 40 * randn(425,227);
```

How does the phase correlation method do now?

6. Try doing something drastic to the tran.tif image, and see whether you can still register the original coke image to your drastically re-worked tran image. For example, you can take a block that is, say 20% of the image area, and swap its location with that of another large block in the image. Or replace a piece with a portion of an unrelated image, or take the square root of the pixel values or whatever. Do you think they can still be registered with the Fourier approach? Try it. What happens?

7. Quadtree segmentation: (This is textbook problem 10.39)

(This is a simple pencil-and-paper problem.) Segment the binary image shown below by using the quadtree segmentation procedure in which $P(R_i)$ = TRUE if all the pixels in R_i have the same intensity. Show the quadtree corresponding to your segmentation.