EE257/GP258 **Lab/Homework #6**
Applied Optimization Laboratory Handout #18
Due: Thurs., Feb. 21

Problem 1 – Convolutions of simple functions.

Using the convolution summation formula, that is without using Fourier transforms, compute the convolution of a two-dimensional rect function of width 512 in both dimensions with itself (since the function is symmetrical this is also the autocorrelation). Compare your result with the analytic result of a lazy pyramid. Time this computation.

Now repeat using the convolution theorem and FFT methods. Ensure you get the same result as before, and time this method of computation.

Lastly, parallelize the FFT approach and see if you can reduce the computation time even further.

Problem 2 – Finding a lost puppy.

Download the file lab6prob2.dat from the web site. Examine this image, it will be a picture of campus with several instances of a picture of a dog embedded in it. The file is a byte file with size 1200x960 pixels. The dog image itself is found in a file called "dog.80x100," a byte file 80 by 100 pixels. Download this also from the web site.

Using correlation methods, find all copies of the dog in the picture.

Note: This approach works best when the average intensity is subtracted from both the full image and from the dog image before correlation. This removes average DC levels and makes the peaks from the correlation stand out much better. So subtract the mean level from each to make these zero mean before applying the correlation calculation.

Problem 3 – Image compression.

Download file lab6prob3.dat from the website. This image consists of 32-bit floating point numbers, not 8-bit samples, and is 1536 pixels wide by 1152 lines long. Display the image after converting it to byte format so you can see what it depicts.

Compress this image using the 8x8 algorithm we discussed in class: break the image into 8x8 sample blocks, compute the 2D Fourier transform, select the N largest coefficients in frequency space, and reconstruct the image from this limited number of coefficients.

Try several different values for N, and see what you would recommend for the best tradeoff between image quality and amount of compression.