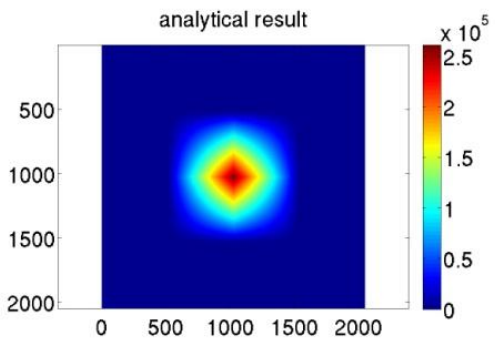
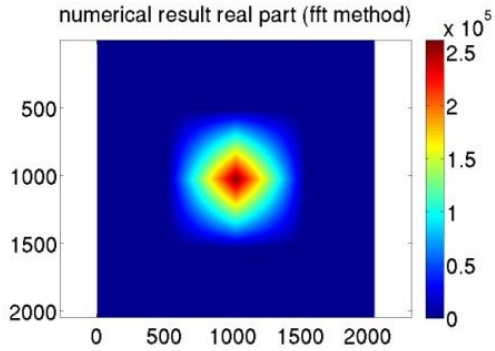
EE 257 Homework 6 Solutions by Ann Chen

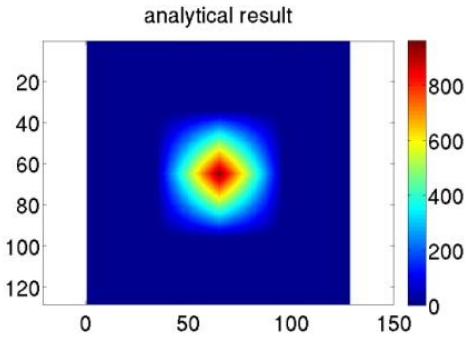
Note: In this solution, we use MATLAB only for plotting.

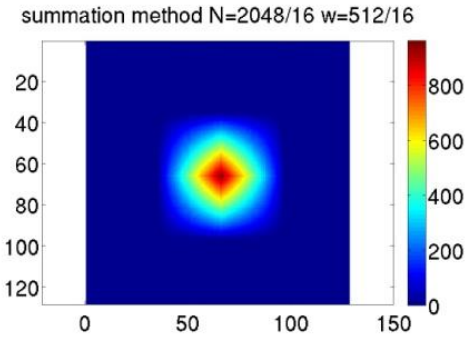
Problem 1

```
For N=2048/16 width=512/16:

fft method (Non Parallel) takes    4.449219      seconds
fft method (Parallel)takes    1.090088      seconds

The convolution summation method takes a lot longer and therefore we
test on a smaller data set.

For N=2048/16 width=512/16:

convolution summation takes    9.199219      seconds
fft method (Non Parallel) takes  7.8125000E-03 seconds
```





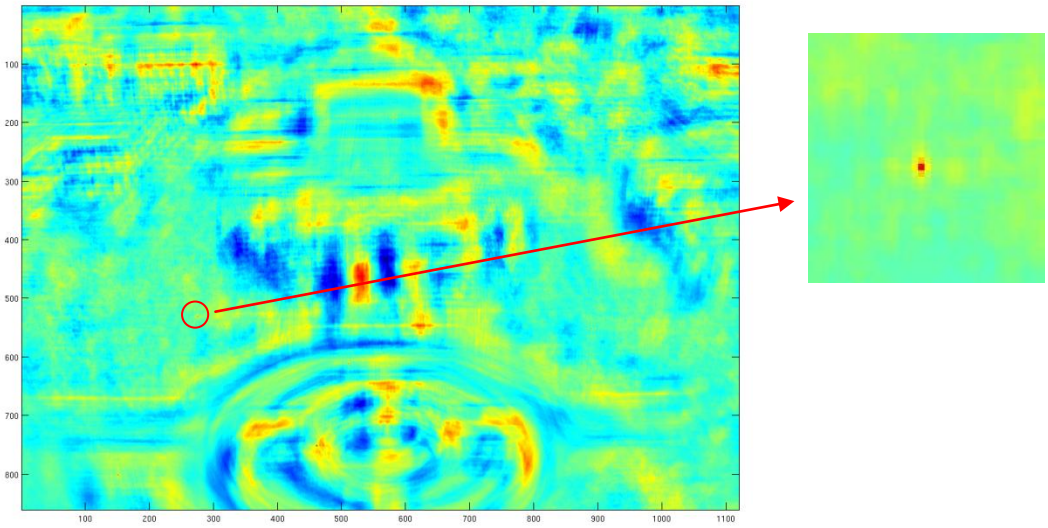




Problem 2

We can compute the cross correlation in Fourier domain (you need to pad zeros to the puppy image so that both images have the same size) and view the results in time domain.

Most of the features you saw correspond to the background pattern. A single pixel with super high value might suggest a puppy. There are at least ten puppies in this figure. To find them, you need to zoom into the image and pick up the pixels with high values. You might also write a subroutine to pick up these pixels.



Problem 3

Suppose we want to save N largest coefficients in Fourier domain, here is a pseudo code:

```
Break the image into 8*8 blocks

for each block "b":

FFT(b)

Find the largest N coefficients and set the rest pixels 0

IFFT(b)
```

In practice, we only need to store the non-zeros and another 1byte array that stores the index of these non-zero coefficients. Since the signal is real, we can use cosine transform instead of fft to further compress the image.