CSE 377 - Homework 1

Fall 2011

Due Thursday, September 22 in class

1. Complex numbers:

a) Plot these numbers into the complex plane: c1=9+i4 and c2=3-i4.
b) Compute their magnitudes and angles.

For the following exercises, give an indication of your solution and draw the result in a coordinate system, with the axes properly labeled with numbers. No rough free-form sketching.

2. Convolution of discrete signals:

a) Draw discrete signal s1(x)=4·Π(x/4) for all $\{x \mid -10 \le x \le 10, x \in Z\}$, *i.e., x* is an integer in the range {-10, 10} and s1 is a box centered at x=0, with amplitude 4 and a total width of 4.
b) Draw discrete signal s2 for all $\{x \mid -10 \le x \le 10, x \in Z\}$: s2=0 for all x<0 and x>5, and else s2(x)=20·$G_{\mu=0,\sigma=2}$(x), where G is the Gaussian function (see handout), here with mean μ=0, standard deviation σ=2, and amplitude 20, but only non-zero for positive x less than 5.
c) Now convolve the two signals and draw the result s3(x) for $\{x \mid -10 \le x \le 10, x \in Z\}$.
d) What do you observe, with respect to the original Gaussian of s2?

2. Image processing: smoothing, filtering and transfer fiunctions

See next page for an "image". Fill in the various plots/images given (label the axes with numbers where appropriate).

image

100	100	10	10	40	40	40
100	100	10	10	40	40	40
100	100	10	10	40	200	40
100	255	10	10	40	40	40
100	100	10	250	10	10	10
100	100	10	10	10	10	10
100	100	10	10	10	10	10

image smoothed with 3x3 box (average) filter

-	-	-	-	-	-	-
-						-
-						-
-						-
-						-
-						-
-	-	-	-	-	-	-

image smoothed with median filter

-	-	-	-	-	-	-
-						-
-						-
-						-
-						-
-						-
-	-	-	-	-	-	-

histogram of median filtered image

transfer function to maximize contrast
in median filtered image

histogram of median filtered image after transfer fiuntion application

3. Image processing: edge detection

See next page for an "image". Use the Sobel filter to find the dx and dy components of the image gradients. Then combine these using the formula |dx|+|dy|. You will get values greater than 255, normalize by scaling the values by a factor 255/maxvalue, where maxvaluie is the highest value that occurs in your edge image.

original image

10	10	200	200	200	10	10
10	10	200	200	200	10	10
10	10	200	200	200	10	10
10	10	200	200	200	10	10
10	10	200	200	200	10	10
10	10	200	200	200	10	10
10	10	200	200	200	10	10

x-edge filtered

-	-	-	-	-	-	-
-						-
-						-
-						-
-						-
-						-
-	-	-	-	-	-	-

y-edge filtered

-	-	-	-	-	-	-
-						-
-						-
-						-
-						-
-						-
-	-	-	-	-	-	-

edge-detected (combine x and y)

-	-	-	-	-	-	-
-						-
-						-
-						-
-						-
-						-
-	-	-	-	-	-	-

normalized (scaled) to [0, 255]

-	-	-	-	-	-	-
-						-
-						-
-						-
-						-
-						-
-	-	-	-	-	-	-