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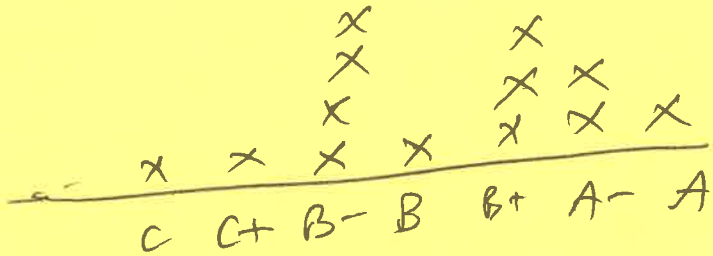
CS4640 Week 7

Quiz 5



Q1. Standard operations

find dimensions of input image

[M,N] = size(im);

and filter

[MF, NF] = size(F);

set up output

B = zeros(M,N);

loop over all pixels (that are OK)

assign value

Q2. Tracking edges to make connected boundaries

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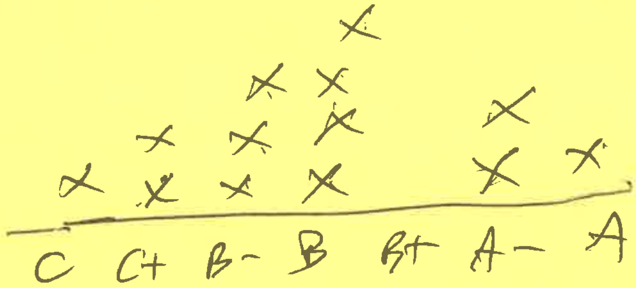
Assignment 3

Put CS4640
Put page #'s



Q1. Mostly OK
some issues performance measure
$|\nabla f|$ is magnitude of gradient
— not a Laplacian
must be thresholded
discuss effectiveness (Ali: good table!)

Q2. Had to develop [-1 3 -3 1] filters
+ show how to modify

code: function only does dx3, dy3
nothing else + NO DRAWING
NO READING
indent header correctly
input/outputs should match header
cast imfilter(im)
as double

don't show figures with no content
develop own codes + methods

Q3. develop own methods
input/output data types

Issues for images (or arbitrary signals)

* not periodic
* 2D instead of 1D

Book shows that letting period $\lambda \to \infty$

results in

$$f(x) = \int_{-\infty}^{\infty} \underbrace{F(k_x)}_{\text{weights function}} \underbrace{\exp(i k_x x)}_{\text{basis functions}} dk_x$$

k_x is continuous

$$F(k_x) = \frac{1}{2\pi} \int_{-\infty}^{\infty} f(x) \exp(-i k_x x)\, dx$$

a complex function:

$$F(k_x) = |F(k_x)| \exp(i\varphi(k_x))$$

where $|F(k_x)|^2 = [Re(F(k_x))]^2 + [Im(F(k_x))]^2$

$$\varphi(k_x) = \tan^{-1}\left(\frac{Im(F(k_x))}{Re(F(k_x))}\right)$$

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Let's make it simple.

The 1D Fourier Transform is: (discrete)

Given $\{x_n\} = x_0, x_1, \ldots, x_{N-1}$

Then the Fourier coefficients are:

$\{X_k\} = X_0, X_1, \ldots, X_{N-1}$

$$X_k = \sum_{n=0}^{N-1} x_n e^{-i 2\pi k n / N}$$

The inverse Fourier Transform is:

$$x_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k e^{i 2\pi k n / N}$$

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Now, what about 2D

The basis functions are now 2D

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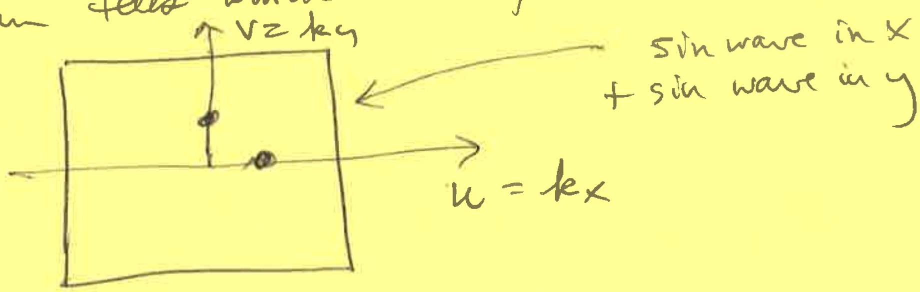
Power spectrum tells which basis functions contribute



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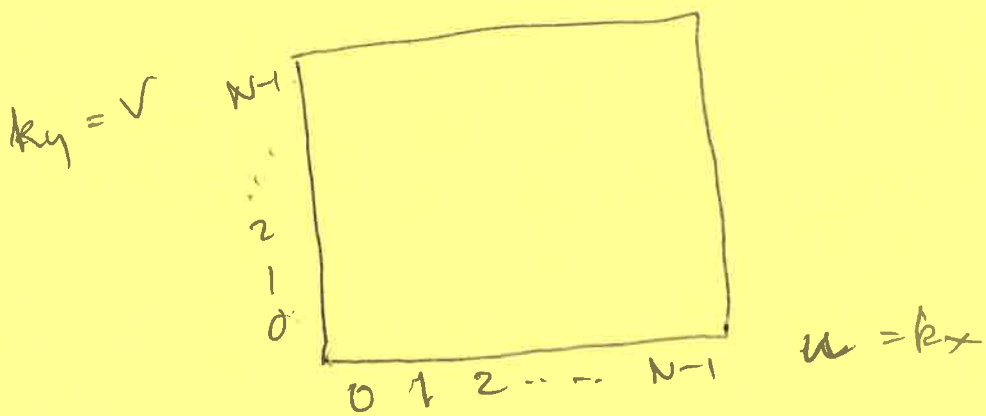
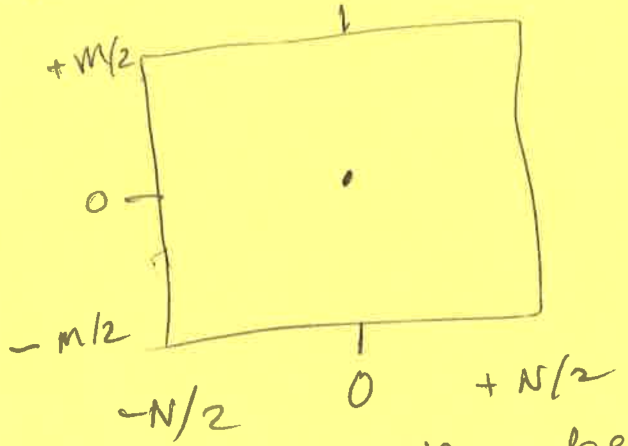
Convolution theorem

$$F\left(f(x,y) ** h(x,y) \right) = \underbrace{F(k_x, k_y)\, H(k_x, k_y)}_{\text{cheaper computationally}}$$

fft2 creates:



centered:



Band pass Filter: smooth: keep low frequencies

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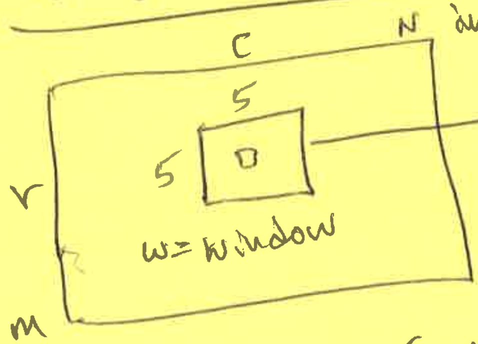
Assignment A4   Q1



$fft2(w) = W$

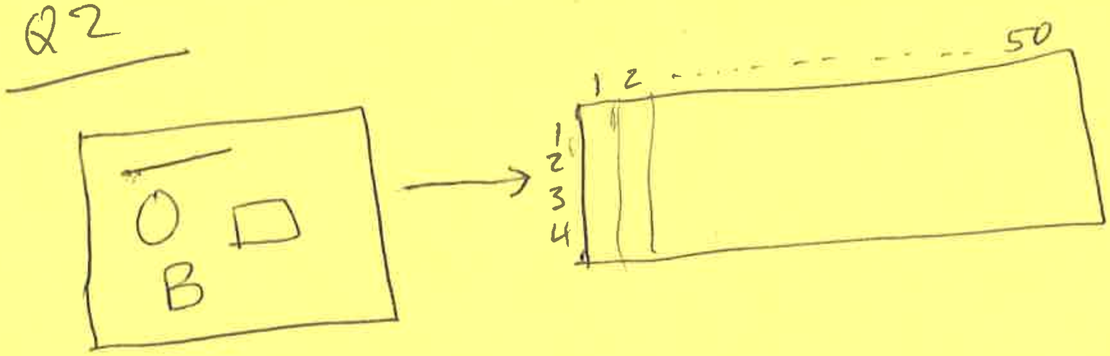
$T(r,c,:) = W(:)';$

pts = reshape(T, m*N, 25);

call kmeans on pts ; pick k

convert cluster indexes back to image

Q2



complex points