Assign 3
Deadline 9th Nov, 11:59 PM

[Practice-theory-ungraded]. Find the DFT of $\sum_{i=0}^{511} \delta(n-256, m-i)$.

[Practice-theory-ungraded]. Perform adaptive filtering.

10	15	0	0	10
0	20	0	0	0
0	**10**	**10**	**0**	20
10	0	0	20	20
10	10	20	20	0

Using the adaptive filter discussed in lecture find the response at bold pixels. Use a 3x3 neighborhood. Assume noise mean is 0 and variance is 2.

Q1. Unsharp masking in spatial domain. [3]
Perform unsharp masking of Barbara' image f using a 5x5 Box filter w. Assume the filter in (0,0) to (4,4).

- First compute $f * w$. You can use any inbuilt function to compute the convolution. Then use only the center part with size same as that of f.
- Compute the mask $f - f * w$. Note that the resultant will have both negative and positive values.
- Add the mask back to f.
- For highboost, add 4 times mask to f.

Display original image, blurred image, unsharp masked image and high boost filtered image.

Q2. Perform Q2 using Fast Fourier Transform (FFT). [3]

- First zero-pad f and w. Then compute respective 2D FFTs F and W (you can use libraries). Finally multiply them elementwise.
- Compute the mask as F – FW
- Add the mask to F and perform 2D IFFT, then take real component.
- For high boost, add 4(F-FW) and take 2D IFFT.

Display original image, unsharp masked image and high boost filtered image.

Q3. Perform filtering using frequency domain filter. [4]
Given cameraman image, add the following noise to the image $\sum_{i=0}^{511}\sum_{j=0}^{5} K\,\delta(n-100j, m-i)$, K = 20, 30, 50.

Design a frequency domain filter which can remove these lines.

Display original image, noisy image, denoised image, magnitude spectrum of original image, noisy image, filter and filtered image. You need to do it separately for different values of K. Note as the lines are horizontal you will see a strong frequency component along vertical line in the magnitude spectrum. All the magnitude spectrums should be centered. You can use inbuilt functions for centering and computing FFT.