EE 637 Homework #3
Spring 1997
Due ?

1) In this problem, you will design and implement an optimum matched filter for detecting a template in an image.

1. Down **load** the image and template you will use in this experiment.
2. Compute the filter $h(m,n)$ with DSFT transform

$$H(e^{j\mu}, e^{j\nu}) = \frac{1}{\sqrt{S(e^{j\mu}, e^{j\nu})}}$$

   where $S(e^{j\mu}, e^{j\nu})$ is the power spectrum of the image.
3. Apply a 7×7 separable Hamming window to $h(m,n)$. Make sure it is centered about the point $h(0,0)$. (You may find the function **circ_shift2.m** useful for doing this.)
4. Subtract the mean from the windowed filter $h(m,n)$ to insure that it is zero mean.
5. Compute the new filter $g(m,n) = h(m,n) * h(-m,-n)$. The new filter $g(m,n)$ will be of size 13×13. Print out an image of the filter $g(m,n)$ and explain its structure.
6. Filter the template image, `tmp.tif`, with the filter $g(m,n)$ to produce the new template $tmp(m,n)$. Only retain the output points for which $g(m,n)$ is contained entirely within the template. Print out the filtered template image $tmp(m,n)$ and explain its structure.
7. Filter the image, img09g.tif, using the space reversed template $tmp(-m,-n)$ to produce the detection output. Print out the detection output and explain its structure.

2) In this problem, you will design and implement an optimum prediction filter for removing distortions in an image.

1. Down **load** the original image img14g.tif, and the three corrupted images, img14bl.tif, img14gn.tif, and img14sp.tif.
2. For each of the three corrupted images, compute an MMSE estimate of the original image using a 7×7 prediction window. (Only use (1/400)th of the points to estimate the optimal predictor. Do this by subsampling by 20 along each direction.)
3. Apply a 5 point median filter to each distorted image.
4. Comment on your results.

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