

Filtering in Spatial Domain

Sharpening an image

1. Apply the following Laplacian to the image

1	1	1
1	-8	1
1	1	1

What do you observe about high and low frequencies (intensity variations) in the resulting image?

2. Blur the original image using a 2nd derivative filter
3. Subtract the blurred image from the original to generate the *mask*
4. Add the *mask* to the original
5. Use equation (1) to perform step 4 and generate images for
 - a. $k=1$ and
 - b. $k>1$

$$g(x, y) = f(x, y) + k g_{mask}(x, y) \quad (1)$$

where $g(x, y)$ is the generated image, $f(x, y)$ is the original and $g_{mask}(x, y)$ is the mask.

What do you observe for images resulting from 5a and 5b?

Filtering Noise

1. Given the following noisy image, apply to it:



- a. An average 3x3 filter
- b. An average 5x5 filter
- c. A 1st derivative 3x3 filter
- d. A 2nd derivative 3x3 filter
- e. A 3x3 median filter
- f. A 5x5 median filter

What do you observe? Which one of the filters removed the noise? Try to justify the reasons...