

LAB 6 - Image Restoration Techniques & 2D Filters- Chapter 7- MATLAB for Image Processing

Lab Report Due: - March 16, 2006.

In this Lab. we do experiments in Chapter 7, pages 7-13 to 7-15.

1. Go over the Image Deblurring Example on page 7-15. Note that the command `[x, y] = ginput(2)` puts cross hairs on the blurred image. You then have to select 2 points with the cross hairs.

One of the fundamental problems in statistical signal processing is the deconvolution problem in additive noise; that is, we have

$$y = x * h + n$$

where x, y, n are the transmitted, received and additive noise signals respectively. The objective is to estimate from y the transmitted signal x when we may or may not know much about x or n .

There are many techniques for deblurring. In this example, you will need only the adaptive Wiener filter deconvolution algorithm `deconvwnr`. Run the example on page 7-15 and see if you can figure out what is happening.

2. Look at the 2D filters generated using `fspecial`. Recall the 2D Gaussian,

$$G(x, y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$

and the Laplacian operator

$$\Delta^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$$

and for $G(x, y) = -\Delta^2\{f(x, y)\}$ in the discrete domain

$$\begin{aligned} G(m, n) = & [f(m, n) - f(m, n - 1)] - [f(m, n + 1) - f(m, n)] \\ & + [f(m, n) - f(m + 1, n)] - [f(m - 1, n) - f(m, n)] \end{aligned}$$

and the Laplacian of a Gaussian (*LoG*) often called the “Mexican hat” in which Gaussian smoothing is performed before application of the Laplacian. Here, generate all the filters. You may want to look at the 3-D spatial plots using `mesh(h)` where h is the 2D impulse response. Amplitude frequency response comes from `freqz2(h)`. Look at the standard Prewitt, Sobel averaging filters. In particular look at the Gaussian, Laplacian and the LoG filters.

REPORT

1. Comment on 1.
2. Comment on 2.

Reference: Image Restoration Techniques, Chapter 7 from MATLAB for Image Processing.
Programs from IPO1.

Class notes:mirchand/ee276