

Digital Image Processing (ECE513)

Computer Assignment 4: Image Restoration using 2-D Wiener Filtering

In this computer assignment, we would like to study the performance of the frequency domain 2-D Wiener filter for de-blurring and noise removal applications. Use the image “Lena” for this assignment.

1. **De-Blurring:** To investigate the use of Wiener filter for de-blurring, first generate a blurred version of the image by introducing horizontal motion blur (discrete version) with a small region of support (truncated). Then, apply a 2-D frequency domain Wiener filter to this blurred image and comment on the performance of this filter for removing motion blur.
2. **Noise Removal:** To investigate the noise removal ability of the Wiener filter, apply this frequency domain filter to the noisy “Lena” image that you generated in Computer Assignment 3. How does the performance (in terms of SNR and visual appearance) compare to those of the spatial averaging filters? Assume you don’t have the prior knowledge of the variance of the white Gaussian additive noise and develop an algorithm to approximately estimate this variance from the observed noisy image.
3. **Image Restoration:** Add white Gaussian noise to the blurred Lena image in Part 1 to generate SNR=5 dB and then apply the 2-D Wiener filter in the frequency domain. Comment on the simultaneous noise removal and de-blurring (i.e. restoration) abilities of the filter.
4. Provide a detailed discussion on the effectiveness of this algorithm for image restoration in a brief report. **Please carefully read the guidelines for preparing your report.**