

ECE431 Homework 8

Due in WisCEL mobi file cabinet for ECE431 at 3pm November 2.

8.1. Image Deblurring. The file `Hmwrk8.mat` contains several images and point-spread functions. `nimes` is an ideal image of Nimes, France. A blurred image is in `nimes_b` and a blurred, noisy image is in `nimes_bn`. Blurring could be caused by a number of factors including atmospheric distortion, while the noise could be due to instrumentation noise, atmospheric effects, and quantization. The noise level is imperceptible to the eye. The point-spread function of the blur is known in this case and is given by `blur` and the inverse point-spread function is given by `invblur`.

- (a) Verify that `invblur` is the inverse of `blur` by convolving them in MATLAB.
- (b) Use `conv2` to apply `invblur` to the blurred image `nimes_b`.
- (c) Apply `invblur` to `nimes_b` in the DFT domain using the 2-D FFT (MATLAB `fft2` and `ifft2`) with no zero padding. Compare the result to that of (b) and discuss the impact of circular convolution.
- (d) Apply `invblur` to `nimes_b` in the DFT domain using the 2-D FFT (MATLAB `fft2` and `ifft2`) with sufficient zero padding to obtain the regular convolution result in (b). What is the minimum amount of zero padding required for circular and linear convolution to give the same result?
- (e) Apply `invblur` to the noisy, blurred image `nimes_bn` using the FFT-based approach. Comment on the impact of noise on the deblurred image. Can you identify an improved deblurring procedure that is less sensitive to noise?

8.2. OS 3.25