Assignment 3 —Filtering in the frequency domain and image restoration

Purpose

- Familiar with programing for image processing
- Understand the basic principle for filtering in the frequency domain and image restoration

Data:
Download two ideal images from internet (with low noise and well contrast).

Work to do:

1. Add Gaussian noise to the two images with zero mean and a variance of 0.2 to the two images; compute and show the Fourier spectrum of each image; Implement the Gaussian lowpass filter and show the filtering results in the spatial domain. Show and analyze your results.
2. Download an image that is corrupted by periodic noise from this link: http://www.scipy-lectures.org/_images/moonlanding.png , compute and show its spectrum; design a butterworth band filter to remove the noise. Show and analyze your result.
3. Add impulse noise (salt-and pepper noise) with Pa=Pb=0.2 to the two images; apply the median filter and the adaptive median filter to the noise corrupted images; compare and analyze your results.
4. Add atmospheric turbulence to the two images according to $H(u,v) = e^{-k(u^2+v^2)^{5/6}}$ with k=0.002, then add Gaussian noise of mean 0 and variance of 5 pixels to the blurred image; Apply a full inverse filtering (with H cut off outside a radius of 70) and a Wiener filtering (with different values of K) to the blurred images, compare and analyze your restored results.

Suggested report format:

- Cover page, with title, course number, name, student ID, date, and abstract,
- Technical discussion. Present the techniques you used for each tasks.
- Results. Show the original images and the results you obtained from each task.
- Analysis. A discussion of your results, your expectation of each operation, did you obtain the results expected? why?
- Appendix. Program list for each task with necessary comments.

Requirements:

- The assignment is due on November 29th 23:59pm local time.
- Submit your report in PDF format to ghwang@ku.edu with the subject "EECS 740 Assignment 3"
- You can use any program language you are familiar with, although Matlab is preferred.
- You can use available functions for these tasks, but you have to write at least one function by yourself.

Available resources

- Chapters 4 and 5 of the textbook
- Matlab Image Processing Toolbox

Evaluation

- Completeness 3/10
- Correctness 3/10
- Results and analysis 4/10