Assignment 5

This assignment is due on October 23, points will be deducted for late homework. **Please include all references, and the names of all students in your study group.**

- Where needed, please add drawings, formulae, and comments to explain your answers. Points will be deducted for incomplete answers.
- All answers should be typed in a word editor of your choice, **not** handwritten.
- Always start a new page for a new problem answer.

1. Create a series of 14 white bars separated by black regions. Each bar should be 11 pixels wide and 230 pixels high. The separation between the bars should be 19 pixels. Demonstrate the effect on the image **(you should implement your own filtering algorithm rather than using PYTHON's built-in functions)**, when
   (a) a 5×5 arithmetic mean filter is applied
   (b) a 5×5 harmonic mean filter is applied
   (c) a 5×5 median filter is applied
   (d) a 5×5 midpoint mean filter is applied

2. Use the Shep-Logan CT phantom to show the effect of a Rayleigh, Exponential and Gaussian noise on the quality images computed using the inverse radon transform function.
   (a) Write an algorithm to compute the projections **(do not use PYTHON's radon function)**.
   (b) Demonstrate your algorithm with different amount of measurement noise (4-noise levels).
   (c) Show that better images (at high noise levels) can be created by employing the filtered back projection method (filtering should be done using a band-limited ramp function).

3. You are given a 2-D matrix (an image) contaminated with an unknown noise or pattern (Q3_imge.mat). Use any tools you have learned in class to filter the image. **Hint**: Filter out (remove) the *bad guy*. Explain what you did and show the final and intermediate results of the image restoration process.

4. Find the angle of a line.
   (a) Write a code that generates an image of a diagonal bar, similar to the image shown in Figure 1. Choose an angle between 20 and 70 degrees to tilt the bar. Indicate the angle.
   (b) Add a Gaussian noise to the image.
   (c) Compute and angle of the bar. Filter the noisy image if needed. Show exactly how you did it.

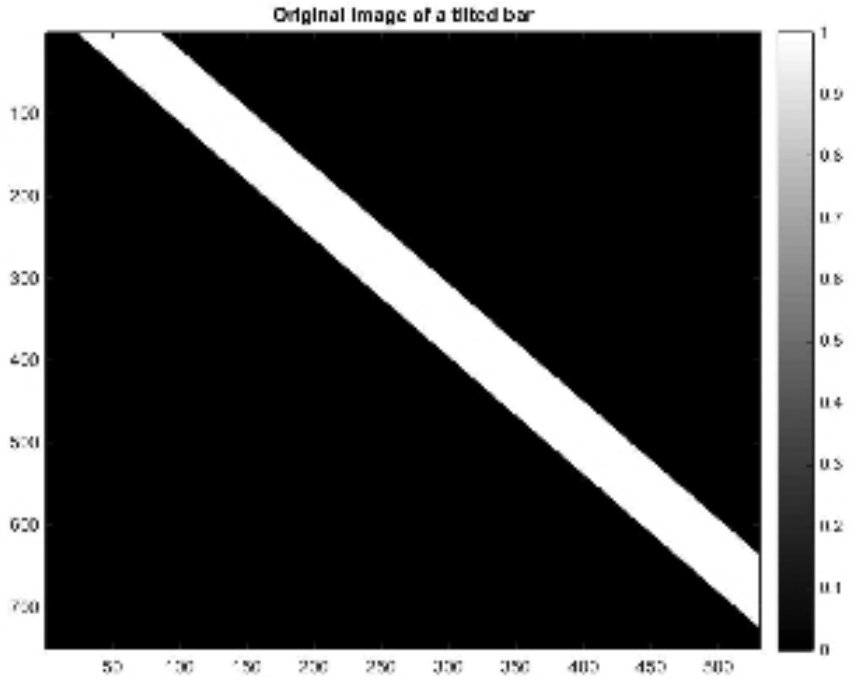

Figure 1: Diagonal bar.