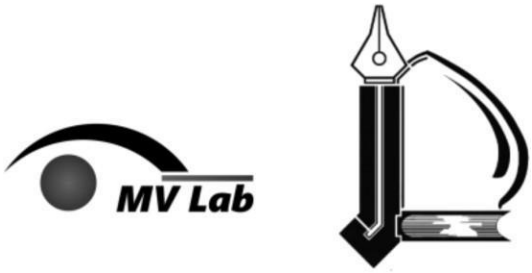

EXERCISE

Instructions

Appendix: Code with comments, Reference, etc.

Delivery

- All homework should be sent through VU (No Telegram, Email, etc.).
- The report should be in PDF format named “Number of Homework-First Name Last Name.pdf”.
- Notice the deadlines.

Points

- Don't use MATLAB, Python, etc. library/toolbox for solving problems (Except math functions)
- Utilize functions when explicitly mentioned in the question.
- Any form of plagiarism will not be entertained and will result in a loss of grade.
- You can compare your own result by MATLAB, etc. output (optional).

2. Contrast Adjustment

2.1. Histogram

2.1.1. Write a program that can compute the histogram of a grayscale image. (Test on Camera Man)

2.1.2. Perform histogram equalization on a grayscale image and compare the new image with the original image. (Test on Camera Man)

2.2. Filters

2.2.1. Write a program that can, first, add salt-and-pepper noise to an image with a specified noise density. Try different noise density (0.05, 0.1, 0.2, 0.4). Then, perform median filtering with a specified window size. Consider only the median filter with a square shape. For each density, discuss the effect of filtering with different window sizes (3, 5, 7, 9) and experimentally determine the best window size. Note: you can use imnoise and MSE functions to generate noisy images and compare the quality of images, respectively. Also, you can ignore the boundary problem by only performing the filtering for the pixels inside the boundary. (Test on grayscale Elaine Image).

2.2.2. Create a program for adding Gaussian noise with different variance and filtering using average and median filter, respectively. Apply the averaging filter and the median filter to an image with Gaussian noise (with a chosen noise variance). Note: You can use imnoise and MSE functions to generate noisy images and compare the quality of images, respectively. (Test on grayscale Elaine Image)

2.2.3. These are often used first-order difference filters in x-direction:

$$a)\ \frac{1}{2}\begin{bmatrix}1 & 0 & -1\end{bmatrix},\qquad b)\ \frac{1}{6}\begin{bmatrix}1 & 0 & -1\\ 1 & 0 & -1\\ 1 & 0 & -1\end{bmatrix},\qquad c)\ \frac{1}{8}\begin{bmatrix}1 & 0 & -1\\ 2 & 0 & -2\\ 1 & 0 & -1\end{bmatrix}$$

Compare the properties of the three filters; (Test on grayscale Elaine Image)

2.2.4. design 3 filters for smoothing , sharpening and removing salt-and-pepper noise on a noisy image and combine these filters to create more sophisticated image processing pipelines that can address a wider range of problems. (Test on grayscale Elaine Image)