CMPE 465 & CMPE 565 - Homework 00

Deadline : 10/10/2019, 23:55

The purpose of this assignment is to familiarize yourself with the fundamental image processing solutions under computer vision problems and Matlab programming language. In this assignment, there are three parts that you should implement.

Note: After completion of your assignment you are required to send one compressed folder that contains your code and report parts. In the code part, you need to create one script for each step. Your reports should contain both visual results that you obtain from your code and observation/explanations. **All codes/reports should be implemented/prepared individually!**

1. In the first part, you are asked to add noise into an image. Perform the following steps:
   (a) Select any RGB image that you want and read it using **imread** function in Matlab.
   (b) Convert the image from RGB to grayscale and finally resize to 256x256 dimension.
   (c) Generate random noise which is the same size as your original image. Finally, add noise to the grays scale image to obtain a noisy image.
   (d) Display both original and noisy images.
2. In the second part of this assignment, you are asked to implement Gaussian filter to remove noise from the noisy image which you obtained in part I.
   (a) Implement Gaussian filter using **fspecial** function in Matlab with using different kernel size and σ parameters. Show the result images.
   (b) Briefly discuss what you infer from result images and analyze different kernel sizes and σ parameters effect on result images.
3. Filtering is the operation to enhance an image like highlighting any features or removing other features of images. In the last part, you are asked to implement spatially filtering operations on your image by convolving. The general formula is given in the following,

   $$\mathrm{G(x,y)} = \mathrm{I(x,y)} * \mathrm{H(x,y)}$$

   where H is the filter function, I is the original image function and G is the result/filtered image function.

   There are 3x3 sized image filters as following.

$$H1 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}, H2 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 0 \end{bmatrix}, H3 = \begin{bmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}, H4 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}, H5 = \frac{1}{9} * \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

(a) Given the filters above, implement these filters on your original image as following.

$G_1 = I * H1$
$G_2 = I * H2$
$G_3 = I * H3$
$G_4 = I * H4$
$G_5 = I * (H2 - \frac{1}{9} * H5)$

(b) Analyze and show result images implemented with these filters.