Digital Image Processing (03/01/2019)

HOMEWORK ASSIGNMENT #1

Image Enhancement and Noise Removal

Due Date: 11:59am on 03/13/2019

Please read the submission guideline carefully before getting started. All images in this homework can be downloaded from our class website: https://ceiba.ntu.edu.tw/1072_DIP. Images are in the raw file format. The size of each image is listed in the appendix.

For MATLAB users, you are **NOT** allowed to use the MATLAB Image Processing toolbox except the imshow() and image() functions.

WARM-UP: SIMPLE MANIPULATIONS

(a) Please perform horizontal flipping on image I_1 as shown in Fig. 1 and output the result as B.

(b) Please perform a power-law transform to enhance B and adjust the parameters to obtain the results as best as you can. Show the resultant images with corresponding parameters and provide some discussions on the results as well.

Fig.1: I_1, sample1.raw

PROBLEM 1: IMAGE ENHANCEMENT

Given a gray-level image I_2 as shown in Fig. 2, please follow the instructions below to create several new images.

(a) Decrease the brightness of I_2 by dividing the intensity values by 2 and output the image as *D*.

(b) Decrease the brightness of I_2 by dividing the intensity values by 3 and output the image as *E*.

(c) Plot the histograms of I_2, *D* and *E*. What can you observe from these three histograms?

(d) Perform global histogram equalization on *D* and *E* and output the results as H_D and H_E, respectively. Please plot the histograms and provide some discussions on the results.

(e) Perform local histogram equalization on image *D* and *E* and output the results as L_D and L_E,

respectively. Please plot the histograms and provide some discussions on the results.

(f) What's the main difference between local and global histogram equalization?

Fig.2: I_2, sample2.raw

PROBLEM 2: NOISE REMOVAL

Given an original image as shown in Fig. 3(a) and two images corrupted by noise as shown in Fig. 3(b) and Fig. 3(c), please follow the instructions below to create some new images.

(a) Design proper filters to remove noise from Fig. 3(b) and Fig. 3(c), and output the resultant images as N_1 and N_2, respectively. Please detail the steps of the denoising process and specify all the corresponding parameters. Provide some discussions about the reason why those filters and parameters are chosen.

(b) Compute the PSNR values of N_1 and N_2 and provide some discussions.

Fig.3(a): sample3.raw

Fig.3(b): sample4.raw

Fig. 3(c): sample5.raw

Appendix:

Warn-up: SIMPLE MANIPULATIONS

sample1.raw	Fig.1	256 x 256 image	gray-scale

Problem1: IMAGE ENHANCEMENT

sample2.raw	Fig.2	256 x 256 image	gray-scale

Problem2: NOISE REMOVAL

sample3.raw	Fig.3(a)	256 x 256 image	gray-scale
sample4.raw	Fig.3(b)	256 x 256 image	gray-scale
sample5.raw	Fig.3(c)	256 x 256 image	gray-scale