HOMEWORK ASSIGNMENT #1
Image Enhancement and Noise Removal

Due Date: 11:59pm on 03/24/2021

Please read the **submission guideline** carefully before getting started. All images in this homework can be downloaded from our NTU COOL website. Images are all in the JPEG format, and the details of all files offered are listed in the appendix. You are **NOT** allowed to use other functions to obtain the result directly except I/O, plotting and basic functions.

Problem 1: WARM-UP (10 points)

(a) The goal of this problem is to get familiar with converting a color image to a grayscale one. Please convert the given color image, **sample1.jpg,** to a grayscale image named **1_result.jpg.**

(b) Please also perform horizontal flipping on **sample1.jpg** and output the result as **2_result.jpg**.


sample1.jpg

Problem 2: IMAGE ENHANCEMENT (60 points)

Given gray-level images **sample2.jpg**, **sample3.jpg** and **sample4.jpg,** please follow the instructions below to create several new images.

(a) Decrease the brightness of **sample2.jpg** by dividing the intensity values by 5 and output the image as **3_result.jpg**.

(b) Increase the brightness of **3_result.jpg** by multiplying the intensity values by 5 and output the image as **4_result.jpg**.

(c) Plot the histograms of **sample2.jpg**, **3_result.jpg** and **4_result.jpg**. What can you observe from these three histograms?

(d) Perform global histogram equalization on **sample3.jpg** and output the results as **5_result.jpg.**

(e) Perform local histogram equalization on **sample3.jpg** and output the results as **6_result.jpg.**

(f) Plot the histograms of 5_result.jpg and 6_result.jpg. What is the main difference between local and global histogram equalization?

(g) Please design a transfer function to enhance **sample4.jpg** as best as you can. Output the result as **7_result.jpg** and specify all the parameters.

Show the resultant image(s) and the corresponding histogram(s). Please provide some discussions on the results as well.
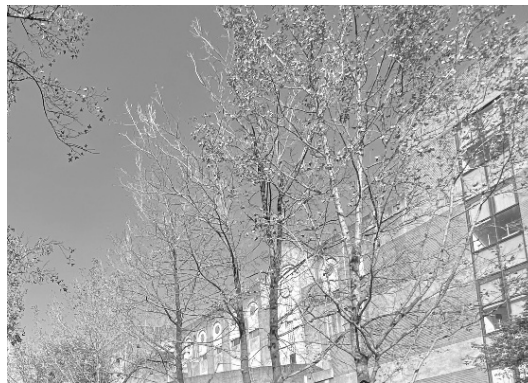
sample2.jpg

sample3.jpg

sample4.jpg

Problem 3: NOISE REMOVAL (30 points)

Given an original image named **sample5.jpg** and two images corrupted by noise as shown in **sample6.jpg** and **sample7.jpg**, please follow the instructions below to create some new images.

(a) Design proper filters to remove noise from **sample6.jpg** and **sample7.jpg**, and output the resultant images as **8_result.jpg** and **9_result.jpg**, 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 **8_result.jpg** and **9_result.jpg** and provide some discussions.

sample5.jpg
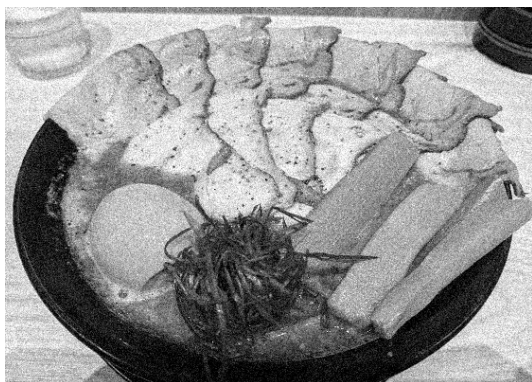
sample6.jpg

sample7.jpg

Appendix

Problem 1: WARM-UP

      sample1.jpg   400×560   color

Problem 2: IMAGE ENHANCEMENT

      sample2.jpg   400×560   gray-scale
      sample3.jpg   400×560   gray-scale
      sample4.jpg   400×560   gray-scale

Problem 3: NOISE REMOVAL

      sample5.jpg   400×560   gray-scale
      sample6.jpg   400×560   gray-scale
      sample7.jpg   400×560   gray-scale