ShanghaiTech University

CS270 Digital Image Processing

Spring 2022

Assignment 1

Due: 23:59, Mar. 30, 2022

1. This homework has 15 points in total. Please submit your homework (report in .pdf format and your codes) to blackboard with both subject and file named like **DIP2021-ID-Name-hw1.zip**. The zip file should contain three things: a folder named **'code'**, a folder named **'images'**, and your report named as **Report-ID-Name-hw1.pdf**. Name the filename of your code **'q1a.m'**(for (a) part of question one) so we can easily match your answer to the question. Please write the report carefully since it contributes the main part of your score.

2. This is an individual homework. While you may discuss the ideas and algorithms, at NO time may you read, possess, or submit the solution code of anyone else (including people not taking this course), or allow anyone else to read or possess your source code. We will detect plagiarism using automated tools and any violations will result in a zero score for this assignment.

Problem 1: Slicing and Filtering(3pts)

Note: you may **NOT** use any built-in functions fspecial() for the tasks.

(a) Pixel values are integers composed of bits. For example, values in a 256-level grayscale image are composed of 8 bits. You are asked to get the bit plane 1-8 from **lena.tif** and show your results. Which plane contains more noise?

(b) Respectively use 3*3 Laplacian Filter Mask, Gaussian Filter and Sobel Filter Mask for both x and y direction on **woman.tif**. Show the result respectively.

(c) Apply Gamma Transformation and Log Transformation to **city.tif** by using different parameters and show your results. Please note that the transformation function should be written by yourselves.

Problem 2: Defogging(6pts)

In this question, the image to process has been provided. You need to do the following steps.

(a) As you can see in Fig1, this is a color image. We'll turn it into a black and white image.

Figure 1: Original Image

(i) We can use imread function in Matlab to read an image into a Matrix, which consists of 3 Channels. Thus, this is a M×N×3 Matrix.

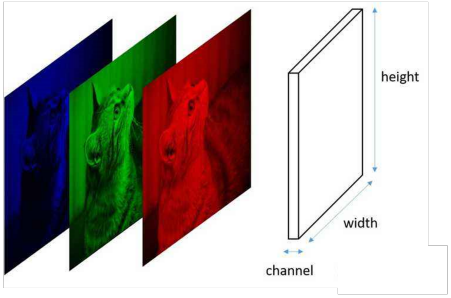

Figure 2: RGB Channel

(ii) We need to construct a new matrix. Its length and width are equal to the length and width of the original image matrix. Each element of this matrix is filled with information in the RGB channels of the original image as shown in Fig3. Therefore, we will get a graph of size M×N×1.

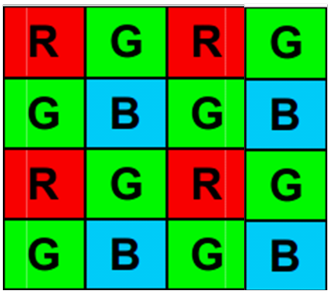

Figure 3: Rearranged Matrix

(iii) You will get a result like Fig4.

Figure 4: Processed Image

(b) You need to somehow remove the fog in Fig4. The result may look similar to Fig5 or better. You can try any filter or intensity transformation method.

Figure 5: Reference result of defogging

Please note that this question does not allow the use of any library functions in the image processing toolbox except for **imread** and **imshow**. Points will be deducted if used.

Problem 3: Connected Domain Search(6pts)

In this problem, we provide a binary image like Fig6. What you need to do is to extract all connected domains that are white using N8 adjacency, see Fig7 for example. The number of all connected domains is 155. Therefore, you need to submit 155 binary images containing a single connected domain.

Important: Usage of built-in functions is restricted in your implementation. In your implementation, only basic bulit-in functions including I/O functions, plot functions, OS functions and basic mathematical / morphological operations are allowed to use for necessary processing, **connected domain searching steps in the process must be implemented by your own code instead of using bulit-in functions**. Your score will be deducted if your implementation contains built-in functions which are not allowed to use (other than the basic ones), depending on how many are used.

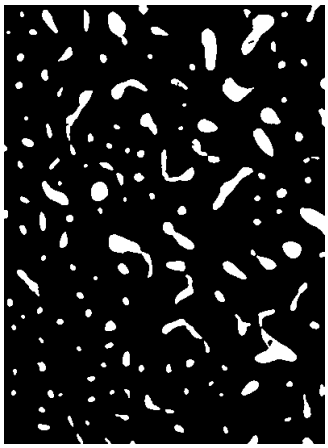

Figure 6: Binary image

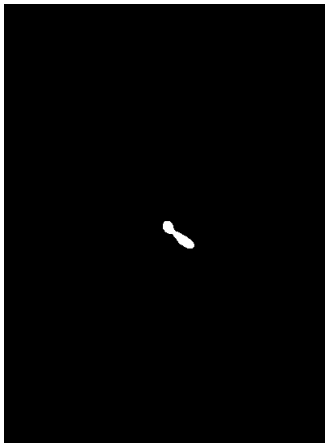

Figure 7: Single connected domain