HOMEWORK ASSIGNMENT 3

Morphological Processing, Texture Analysis

Due Date: 11:59 pm on Apr. 21, 2021
Please read the **submission guideline** carefully before getting started. All images in this homework are in PNG format and can be downloaded from our `NTU COOL` website. Details of all files offered are listed in the appendix. You are **NOT** allowed to use other functions except I/O, plotting and basic functions.

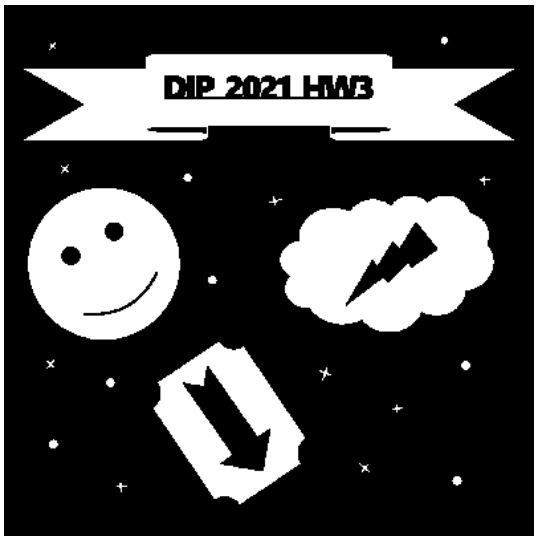
Problem 1: MORPHOLOGICAL PROCESSING

A binary image, **sample1.png**, is given in Figure 1. Please implement several morphological operations and provide discussions about the results. (Note that the white pixels represent foreground objects and the black pixels are background.)

(a) (`15 pt`) Perform boundary extraction on **sample1.png** to extract the objects' boundaries and output the result as **result1.png**.

(b) (`15 pt`) Perform hole filling on **sample1.png** and output the result as **result2.png**.

(c) (`30 pt`) Please design an algorithm to count the number of objects in Figure 1. Describe the steps in detail and specify the corresponding parameters.



(a) sample1.png

Figure 1: The test image for morphological processing.

Problem 2: TEXTURE ANALYSIS

In this problem, there is an image **sample2.png** composed of several different textures.

(a) (`10 pt`) Perform Law's method on **sample2.png** to obtain the feature vector of each pixel and discuss the feature vectors in your report.

(b) (`10 pt`) Use k-means algorithm to classify each pixel with the feature vectors you obtained from (a). Label same kind of texture with the same color and output it as **result3.png**.

(c) (`20 pt`) Based on **result3.png**, design a method to improve the classification result and output the updated result as **result4.png**. Describe the modifications in detail and explain the reason why.

(d) (`Bonus`) Try to replace the flowers in color or gray-scale **sample2.png** with **sample3.png** or other texture you prefer by using the result from (c), and output it as **result5.png**.
It's allowed to utilize external libraries to help you accomplish it, but you should specify the implementation detail and functions you used in the report.

(a) sample2.png (color)

(b) sample2.png

(c) sample3.png

Figure 2: Images for texture analysis.

Appendix

Problem 1: MORPHOLOGICAL PROCESSING

sample1.png:	400×400	gray-scale

Problem 2: TEXTURE ANALYSIS

sample2.png:	400×600	gray-scale
sample2_color.png:	400×600	color
sample3.png:	150×200	gray-scale