HOMEWORK ASSIGNMENT 3

Morphological Processing, Texture Analysis

Due Date: 11:59 pm on Apr. 6, 2022
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

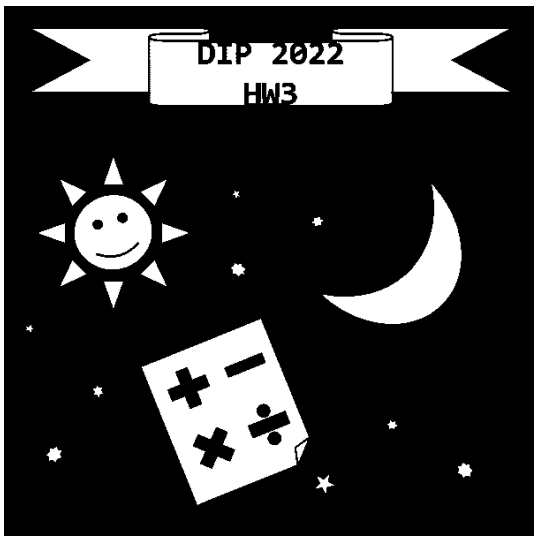
A binary image, **sample1.png**, is given in Figure 1. Please implement several morphological operations to meet the following requirements and provide discussions on each of the results. (Note that the white pixels represent foreground objects and the black pixels are background.)

(a) (`10 pt`) Design a morphological processing to extract the object' boundaries in **sample1.png** and output the result as **result1.png**.

(b) (`10 pt`) Perform hole filling on **sample1.png** and output the result as **result2.png**.

(c) (`15 pt`) Apply skeletonizing to **sample1.png** and output the result as **result3.png**. Reverse foreground and background pixels and apply skeletonizing to the resultant image. Output the skeletonized result as **result4.png**. What can you observe from **result3.png** and **result4.png**?

(d) (`15 pt`) Perform connected component labeling on **sample1.png** to count the number of objects and obtain an image **result5.png** where different objects are labeled with different colors. Describe the steps in detail and specify the corresponding parameters.



(a) sample1.png

Figure 1: The input image for morphological processing.

Problem 2: TEXTURE ANALYSIS

In this problem, an image **sample2.png** of a natural scene is given in Figure. 2(a).

(a) (`10 pt`) Perform Law's method on **sample2.png** to obtain the feature vectors. Please describe how you obtain the feature vectors and provide the reason why you choose it in this way.

(b) (`20 pt`) Use k-means algorithm to classify each pixel with the feature vectors you obtained from (a). Label the pixels of the same texture with the same color and output it as **result6.png**.

(c) (`20 pt`) Based on **result6.png**, design a method to improve the classification result and output the updated result as **result7.png**. Describe the modifications in detail and explain the reason why.

(d) (`Bonus`) Try to perform **image quilting**, replacing the flowers in **sample2.png** with **sample3.png** or other texture you prefer by using the result from (c), and output it as **result8.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

(b) sample3.png

Figure 2: Images for texture analysis.

Appendix

Problem 1: MORPHOLOGICAL PROCESSING

sample1.png:	600×600	gray-scale

Problem 2: TEXTURE ANALYSIS

sample2.png:	600×900	gray-scale
sample3.png:	200×200	gray-scale