

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.

- R (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
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Problem 2: TEXTURE ANALYSIS

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