

# HOMEWORK ASSIGNMENT 3

## Texture Analysis, Shape Analysis

**Due Date :** 11:59 am on 05.27.2020

Please read the **submission guideline** carefully before getting started. All images in this homework are in JPEG 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: Texture Analysis (50 pt)

Given **sample1.jpg** as shown in Figure 1, your task is to segment and label the zebra, grassland and sky with different intensity values and output the result as **result1.jpg**. You may perform **Laws' method and k-means algorithm** to achieve the goal (for this problem,  $k = 3$ ). Furthermore, you have to describe the following points in detail and discuss how they affect the performance.

- (i) The way you compute the energy.
- (ii) The way you choose the initial points when performing k-means.
- (iii) The way you calculate the distance in k-means.



Figure 1: sample1.jpg

## Problem 2: Shape Analysis (50 pt)

Given a training set as shown in Figure 2, please design a recognition system for license plates and perform it on **sample2.jpg**, **sample3.jpg** and **sample4.jpg** as shown in Figure 3, respectively. In other words, a license plate image serves as an input to the system, and the output is its corresponding characters. For example, if the input is **sample2.jpg**, your program should output "EMB0588". Note that you don't have to deal with the special character, "-". Please provide the flow chart along with the detailed descriptions of your algorithm. Also show the results and discuss on both the successful and failure cases.

A B C D E F G H I J K L  
M N O P Q R S T U V W  
X Y Z 0 1 2 3 4 5 6 7 8 9

Figure 2: Training set



(a) sample2.jpg



(b) sample3.jpg



(c) sample4.jpg

Figure 3: License plate images sample2, sample3, and sample4

## BONUS (50 pt)

For the problem you selected, please provide the results, the details of your method, and some discussions in the report.

- (a) (20 pt) Please design a recognition algorithm to recognize the characters on the license plate, **sample5.jpg** as shown in Figure 4. Certain pre-processing might be required and you may also define your own training set. However, cropping **sample5.jpg** directly to create the training set is not acceptable.



Figure 4: sample5.jpg

- (b) (30 pt) Use the sketch and selfie you submitted in student information form and try to combine them as displayed in Figure 5. You should do the transform by yourself. Any commercial software is not allowed in this problem.

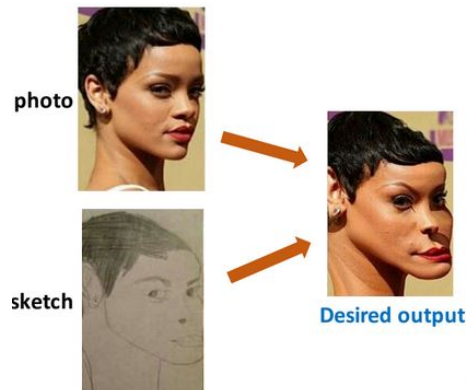


Figure 5: Example of combining sketch and selfie

## Appendix

Image Files:

1. sample1.jpg:  $705 \times 1000$
2. sample2.jpg:  $135 \times 313$
3. sample3.jpg:  $131 \times 266$
4. sample4.jpg:  $178 \times 440$
5. sample5.jpg:  $1242 \times 1920$
6. TrainingSet.jpg:  $540 \times 1240$