Lab 5 - Image Processing EEE412

--Morphological Operations

Report is due 14 days from the date of running this lab

Matlab functions:

The following are some built-in *Matlab* functions that might be used in this session:

```
strel imerode, imdilate, imopen, imclose, bwhitmiss, sprintf,
```

Hint: read the help about each of the previous functions and any other function you might use. Some Matlab functions have a section describing the *Algorithm(s)* they use; it is worth reading this section.

Tasks:

1. Morphological operation on the image of *im_sawtooth*. (**40 marks**)
   Firstly, load the image *sawtooth.bmp* as *im_sawtooth.*
   (1) Extract the boundary of the image, and show it in the report. (**10** marks)
   (2) Do the operations of erosion, dilation, opening, and closing. Please use the function of strel to create the structuring element with the shape of disk (You can set your preferred radius). Show the results after each operations and calculate the number of foreground pixels. Write your comments on comparing the results of erosion and opening. (**20** marks).
   (3) Repeat the opening operation several times with the same SE. What do you find? And Why? (**10** marks)

2. Car License Plate Recognition (1) (**30 marks**)

   In this task you will learn how to recognize the alphanumeric characters on a license plate using morphological image processing.

   Firstly, you need to binarize the license plate (`im`) and the alphanumeric template images; the background of all these images should be black, whereas, the foreground representing the objects that need to be detected (i.e., in this case the alphanumeric characters) is white. While doing so use the same threshold for all the binarization

operations. In you report submit the binarized plate image, and describe your binarization approach. **(10 marks)**

Perform character detection by using the erosion operation on the binarized version of the image. There might be some small mismatches along the character boundaries between the license plate and the template images. To eliminate this mismatch, you might use a smaller version of the characters in the templates, which could be achieved by eroding the templates before using them in the detector.

Write a Matlab function which detects the car license plate and outputs it as a string. The function should have the following declaration:

```
function [str] = detect_car_license_plate_v1(im, …
```

Include in your report the detected car license plate, and comment on your finding, if there were any anomalies then comment on them and explain why they happened. **(20 marks)**

3. Car License Plate Recognition (2) (**30 marks**)

   Repeat the previous task using a hit-miss filter instead of the erosion operation. Write a Matlab function for this task which has the following declaration:

   ```
   function [str] = detect_car_license_plate_v2(im, …
   ```
   (10 marks)
   For the hit-miss filter and for the foreground Structure Element use the eroded template as in task 2. For the background Structure Element use the outline around the character. Comment on the advantages of this approach and compare it with the one used in task 2. **(20 marks)**

Lab Report

Write a short report which should contain a concise description of your results and observations. Include listings of the Matlab scripts that you have written. Describe each of the images that you were asked to display.

Submit the report electronically and a hardcopy version into the white collecting box beside the office EB310 (Hand written reports are not accepted).

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