

## Lab 5 - Image Processing EEE330

### Morphological operations

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

#### Introduction:

This assignment focuses on the morphological operations, which has two main tasks. In both tasks, the students will design algorithms based on morphological operations to solve the problems. The assessment includes the programming code and the report. The programming code should be run successfully, and the results should be correct. Moreover, the code quality will also be considered, such as efficiency, comments, robustness. The report should answer all questions in the tasks, and explain them clearly. It is recommended to add some conclusions about the whole lab.

#### Objectives:

To test the student learning outcomes A, B, C, and D.

#### Download:

Download the file *Lab5-material.rar* from ICE unzip this file. The unzipped folder will contain the following images:

- i. An image *car\_license\_plate.png* (load it into Matlab as `im_license`).
- ii. An image *alphanumeric\_templates.png* contains 36 separated alphanumeric characters used in the *car\_license\_plate.png*
- iii. An Image *Coins.jpeg* (load it into Matlab as `im_coins`).

#### Matlab functions:

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

`imerode, imdilate, bwhitmiss, bwmorph, sprintf, ...`

Hint: read the help about each of the above 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. Counting the coins (**20 marks**)

Considering the following image (`im_coins`), please design a proper morphological-based solution to count the coins automatically.

Write the number of the coins and describe your algorithm in your report.

Tips: Maybe you can use saturation information (HSV color model) to binarize this image first.



Figure 1: coins to be counted

### 2. Car License Plate Recognition (**60 marks**)

*“Automatic number plate recognition (ANPR) is a mass surveillance method that uses optical character recognition on images to read vehicle registration plates. They can use existing closed-circuit television or road-rule enforcement cameras, or ones specifically designed for the task. They are used by various police forces and as a method of electronic toll collection on pay-per-use roads and cataloging the movements of traffic or*

*individuals. Systems commonly use infrared lighting to allow the camera to take the picture at any time of the day. The software aspect of the system uses a series of image manipulation techniques to detect, normalize and enhance the image of the number plate, and then optical character recognition (OCR) to extract the alphanumerics of the license plate.”<sup>1</sup>*

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

- (a) Firstly you need to binarize the license plate (`im_license`) and the alphanumeric template image; 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. In your report, please submit the binarized plate image, and describe your binarization approach. **(10 marks)**
- (b) Perform character detection by using erosion operation on the binarized license. There might be some small mismatches between the license plate’s character and the alphanumeric template image. To eliminate this mismatch you might use a smaller version of the characters in the templates, this could be achieved by eroding the templates before using them in the detector. **(10 marks)**
- (c) 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 the detected car license plate in your report, and comment your finding, if there were any anomalies then comment them and explain why they happened! **(20 marks)**

- (d) 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, ...
```

For the hit-miss filter, you can use the eroded template as in the previous task (c) for the foreground Structure Element, and use the outline around the character for the background Structure Element. Comment on the advantages of this approach and compare it with the one used in the previous task (c). **(20 marks)**

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<sup>1</sup> From [http://en.wikipedia.org/wiki/Automatic\\_number\\_plate\\_recognition](http://en.wikipedia.org/wiki/Automatic_number_plate_recognition)

## Lab Report

Write a 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. The format of report should be like this, which is repeated for all questions.

Question

(a) Answers

(b) Figures if you have. Please add figure title.

(c) concise code

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

**Assignment set date is the 16<sup>th</sup> May 2018, and the due date is the 30<sup>th</sup> May 2018.**

### Marking scheme

80%-100% Essentially complete and correct work.

60%-79% Shows understanding, but contains a small number of errors or gaps.

40%-59% Clear evidence of a serious attempt at the work, showing some understanding, but with important gaps.

20%-39% Scrappy work, bare evidence of understanding or significant work omitted.

<20% No understanding or little real attempt made.

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