

# **DMET 901: Computer Vision**

## **Assignment 2**

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## Question 1:

1- L1.jpg:

By applying threshold on the image where any value greater than 127 is considered to be white and any value less then or equal to it is considered to be black, the following image was the result.



*Figure 1: L1 in binary*

Applying 8 connected component labeling resulted in 645 different classes.

L3.jpg:

Using the front view image of L3 ,which was generated from assignment 1, The following image was used.



*Figure 2: Front view of L3 in gray scale*

By dividing the pixels into 4 category based on their values and the applying 8 connected component labeling, the result was 4161 different classes.

The division was made according to the following table:

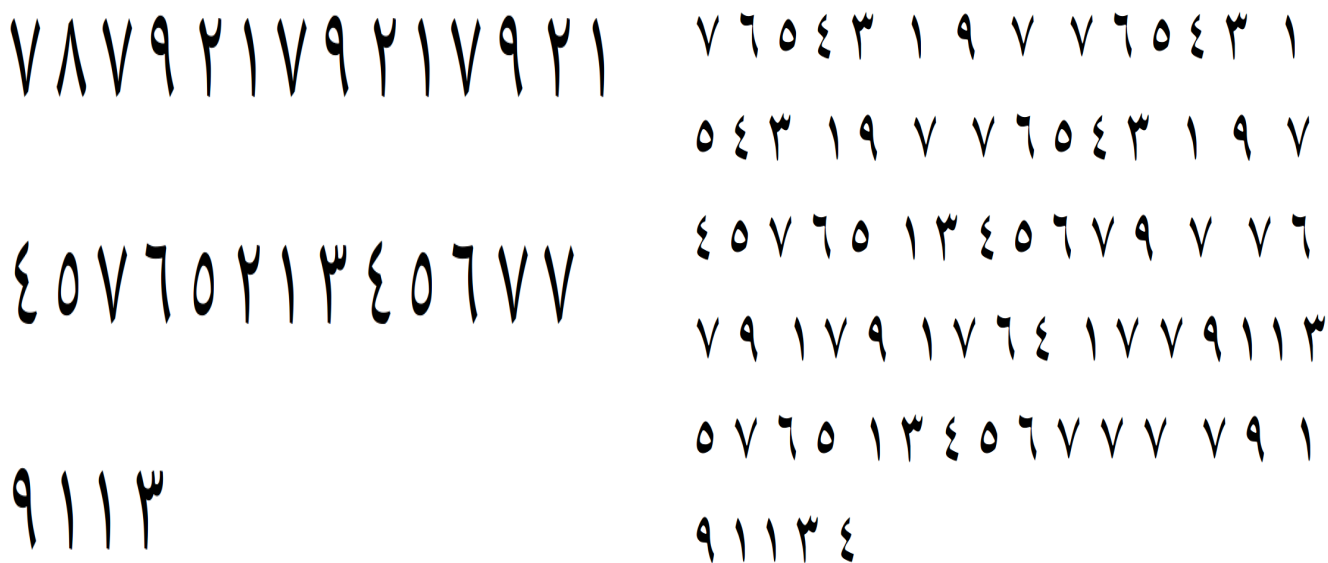
Pixel value	Category
0 – 63	1
64 – 127	2
128 – 191	3
192 – 255	4

### Question 2:

The answer to this question can be divided into 2 part. The 1<sup>st</sup> one is the training phase and the other one is the testing or extraction phase.

### 2.1 Training Phase:

The training phase aims at teaching the program what the different numbers and letters look like. This can be accomplished by using different shapes of the same character so that the program can extract the characteristics of each element on its own. The following pictures show a sample of the data used to train the engine.



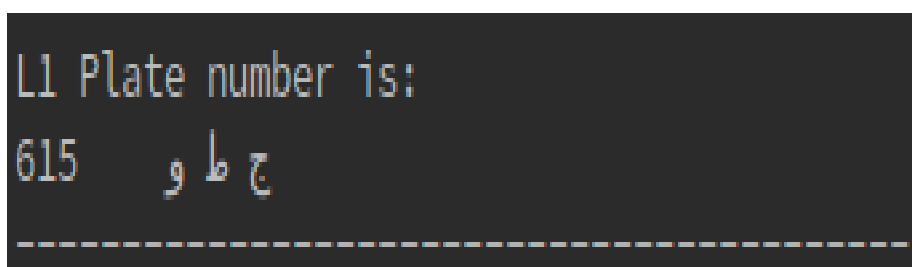
The same technique is applied to letters too. Then the characteristics of each character is saved to a text file where the engine can refer to in the second phase. Around 6 or more different samples of different formats are used to guarantee the best performance of the engine.

The following paragraph demonstrates the flow of the program.

Each character in the images shown above is separated using the built-in OpenCV function “cv2.findContours”. Then each element is shown to the user separately waiting for the user to press a keyboard button corresponding to the value of that element. For example, when the current element to define is 3, the user presses 3 from the keyboard.

## 2.2 Data extraction phase (Testing phase):

In this phase, the text files made by phase one is used to compare the plates contents to the characteristics stored. At the beginning a Gaussian filter and a threshold are applied to the image in order to remove most of the noise from the plate image which may affect recognizing the characters. Then all images are scaled to the same size in order to guarantee the same behavior for all images. Each character is separated from the others by using the build in OpenCV function “cv.findContours”. A filtering if condition makes sure that the separated element is over a specific size to eliminate noise and to ignore English letters and numbers in images that contains them. The remaining contours are then processed and compared to the data file. The character in data files which has the most similarity with the contour is chosen. The following 2 images show the output of the program for L1 and L3 respectively.



*L1.jpg Result*

```
L3 Plate number is:  
475    ب ج د  
-----
```

*L3.jpg Result*

The program was tested with other images outside the scope of the provided dataset and it showed a stable and efficient performance.