EE7374 – Digital Image Processing

Homework 5

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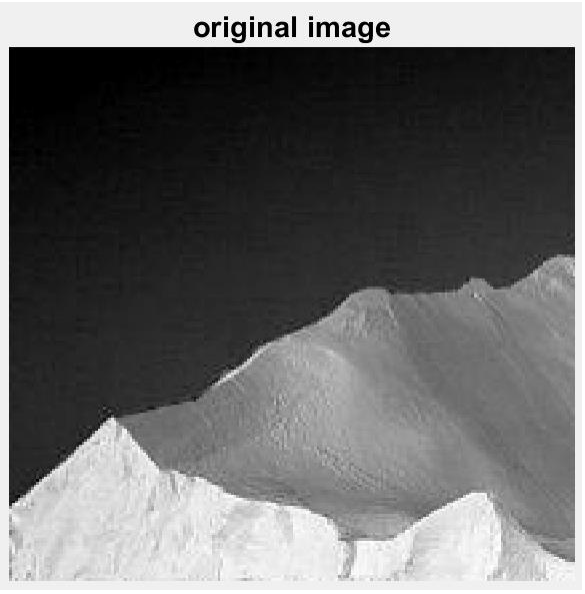
1. Otsu's thresholding algorithm

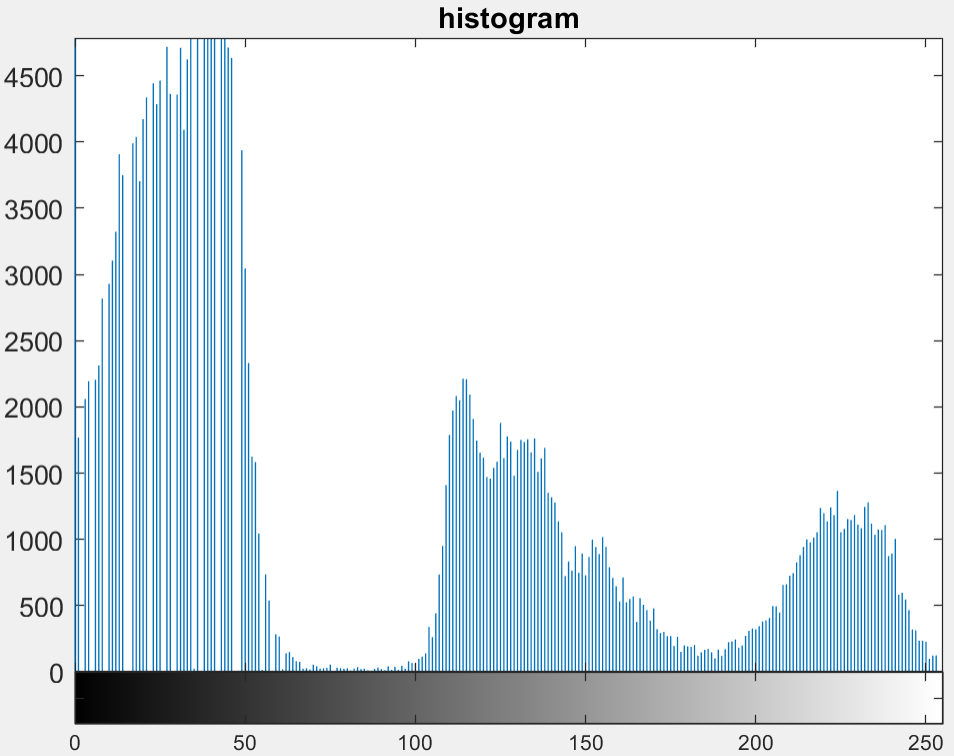
Deliverables & Questions

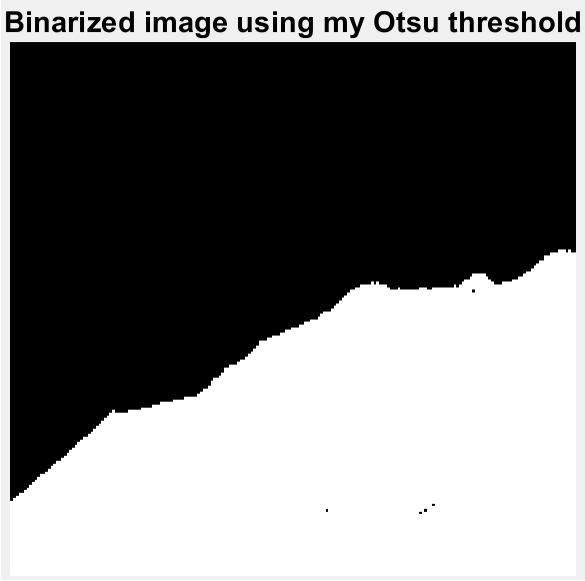
1. Completed MATLAB code for `HWK5_ImageThreesholding.m` and `my_GrayThresh.m`
2. What is the mean gray level in the entire image?
   It's 87.2511
3. What is the gray value associated with the Otsu threshold? How does it compare to the mean value of the image?
   The gray value associated with the Otsu threshold is 97, it's larger compared to the mean value.
4. How does your Otsu threshold compare to MATLAB's implementation of Otsu thresholding using the `graythresh` function?
   The results are same.

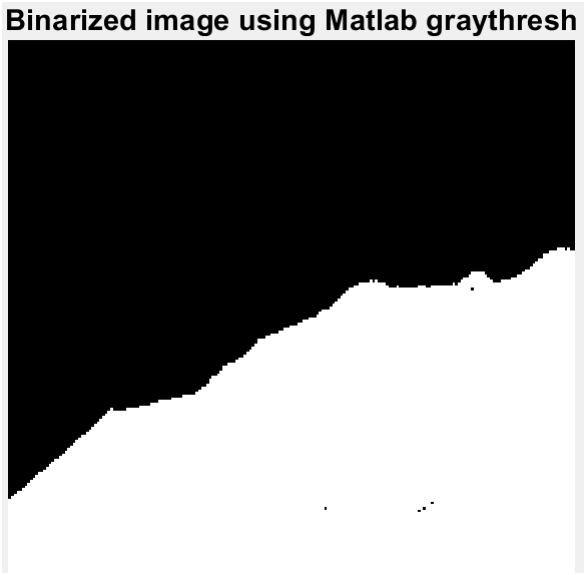
```
My Otsu threshold 0.376471
MATLAB Otsu threshold 0.376471
```

5. Screenshots of the original image, its histogram and the binarized image obtained using your Otsu thresholding. Label each screenshot clearly. Failure to do so will result in deduction of points.



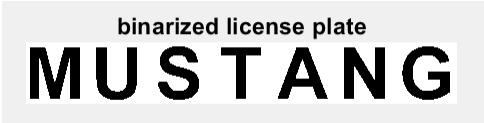

histogram
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250

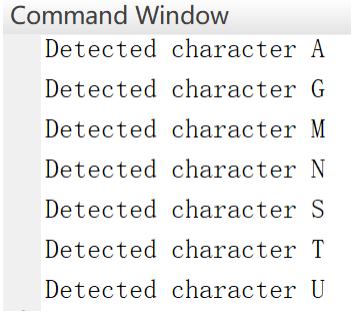

Binarized image using my Otsu threshold

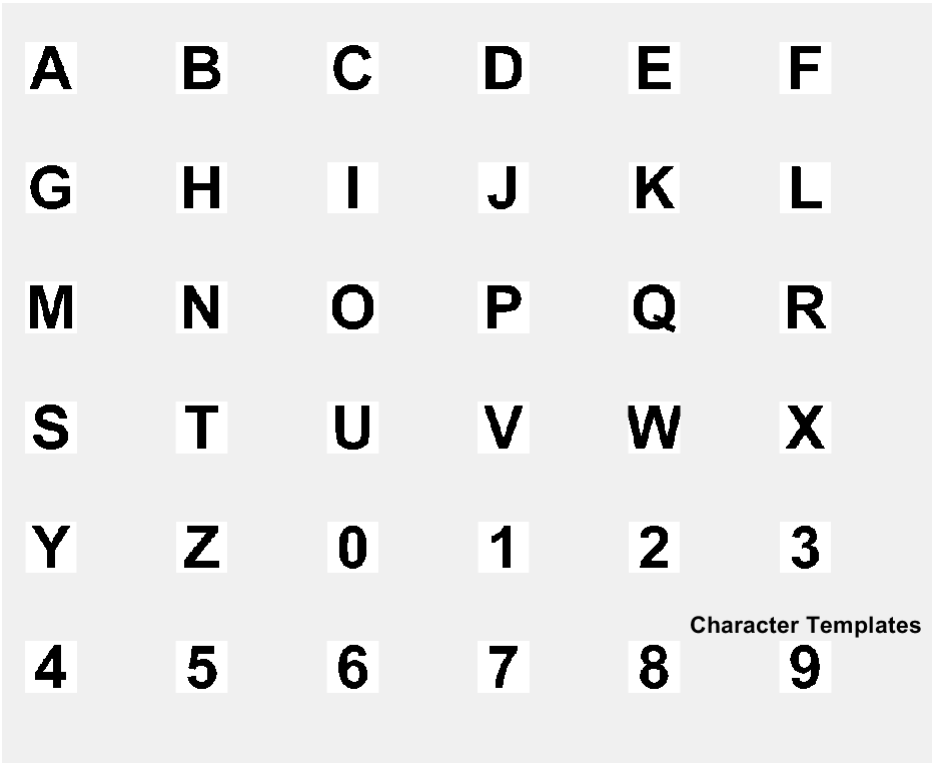


2. License plate recognition

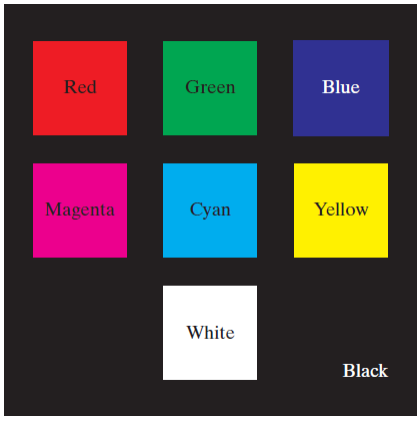
1. Completed MATLAB code for `HWK5_LicensePlateRecognition.m`.
2. Screenshots of the binarized license plate and the 7 detected characters. Label each screenshot clearly. Failure to do so will result in deduction of points.







3. Problem 7.13 in 4th edition of Gonzalez and Woods



Answer:

First we need to convert color from RGB to HSI, and the hue component is obtained using the equation:

$$H = \begin{cases} \theta & \text{if } B \le G \\ 360 - \theta & \text{if } B > G \end{cases}$$

with†

$$\theta = \cos^{-1}\left\{\frac{\frac{1}{2}\left[(R-G)+(R-B)\right]}{\left[(R-G)^2+(R-B)(G-B)\right]^{1/2}}\right\}$$

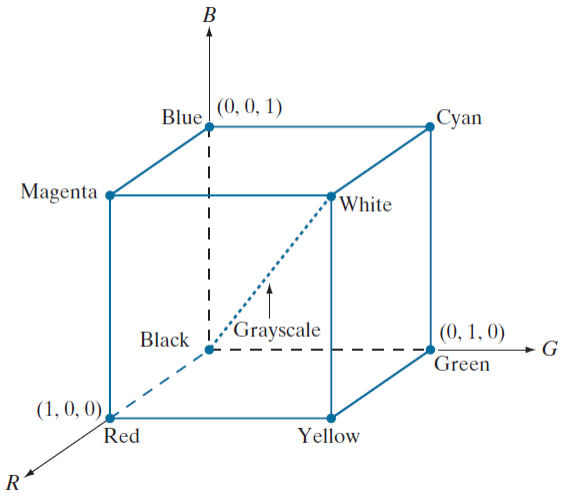
And saturation component is given by

$$S = 1 - \frac{3}{(R+G+B)}\left[\min(R,G,B)\right]$$

Finally, the intensity component is obtained from the equation

$$I = \frac{1}{3}(R+G+B)$$

Then we can get the RGB value of each color using following figure



Black (0,0,0) H: doesn't exist because the denominator cannot be zero S: doesn't exist I: 0

Red (1,0,0) H: 0 S: 1 I: 0.33

Green (0,1,0) H: 120 S: 1 I:0.33

Blue (0,0,1) H: 240 S: 1 I:0.33

Magenta (1,0,1) H:300 S:1 I:0.66

Cyan (0,1,1) H: 180 S:1 I:0.66

Yellow (1,1,0) H: 60 S:1 I:0.66

White (1,1,1) H: doesn't exist because the denominator cannot be zero S: 0 I: 1

So the final results are:

Hue			Saturation			Intensity		
0	2	4	1	1	1	0.33	0.33	0.33
5	3	1	1	1	1	0.66	0.66	0.66
	#			0			1	
		#			#			0