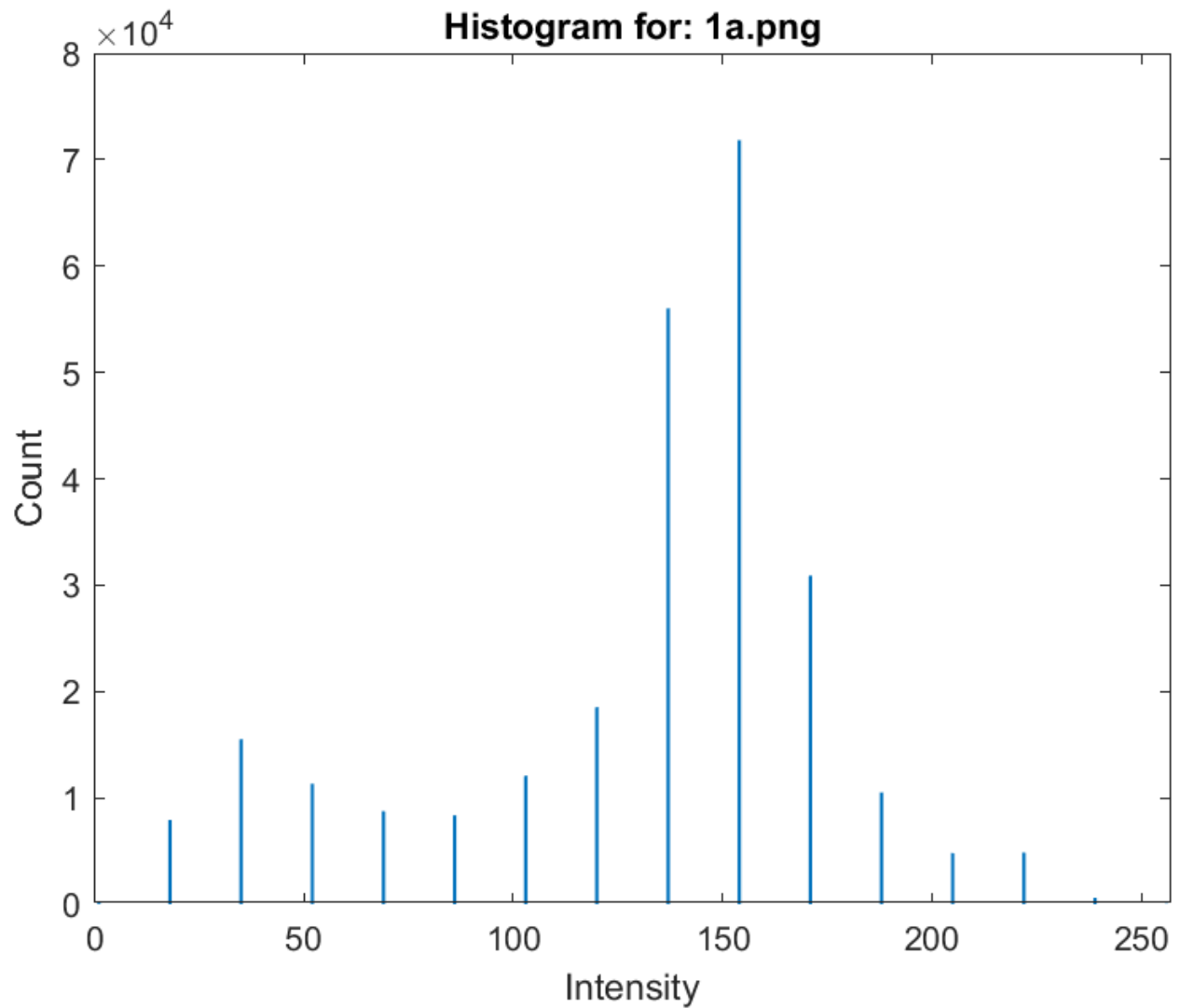


Görkem Yılmaz

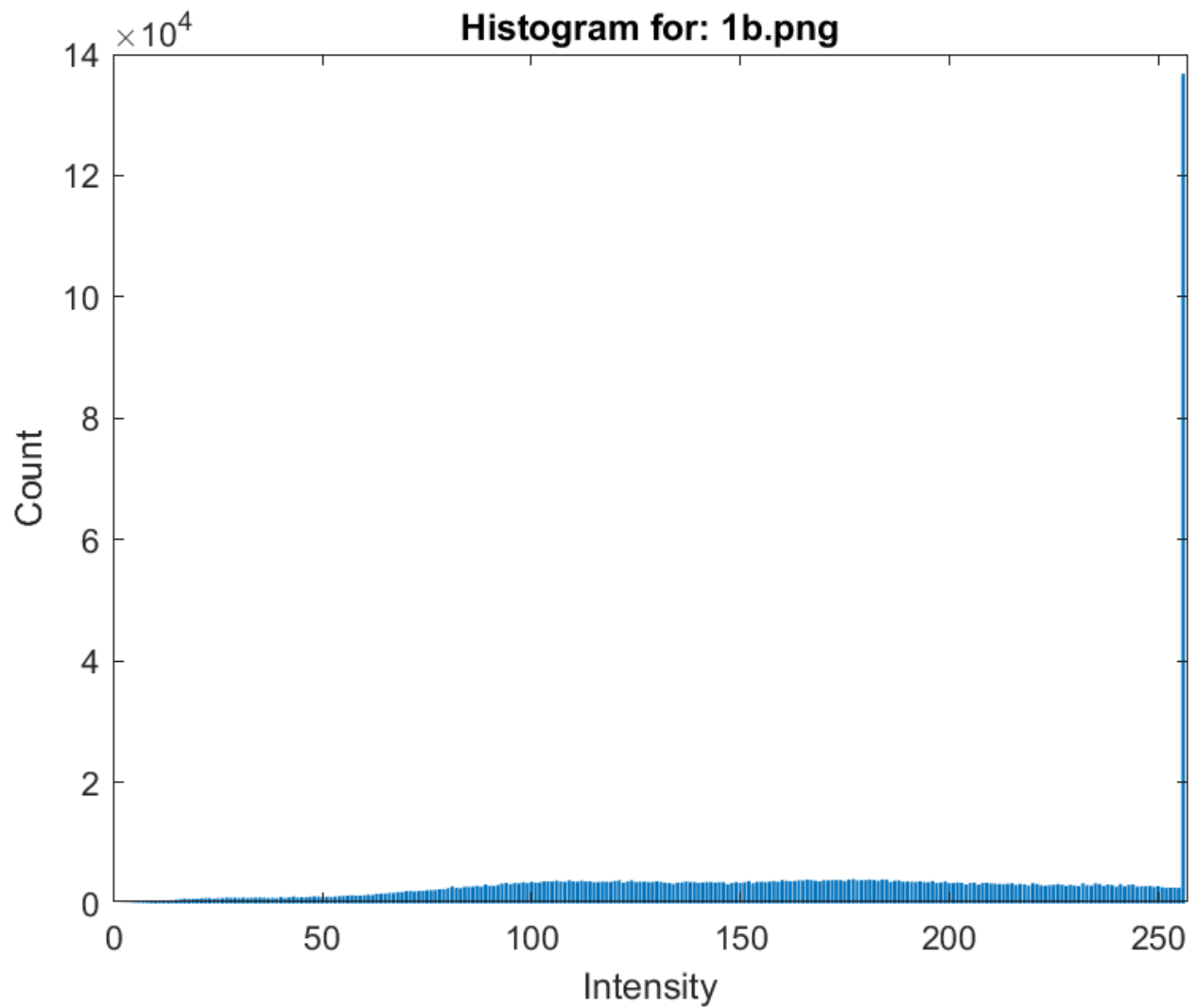
CS 484 – Introduction to Computer Vision

Homework 1 Report

Question 1)



As for this image 1a.png, resulting histogram shows that peak intensity has a value around 150 because the image mostly has pixel values between ~ 125 - ~ 175 . This states that image contains mostly gray areas because 0 means black and 255 means white.



For this histogram of image 1b.png, it can be said that the image mostly contains white pixels because peak intensity value is 250 and it corresponds to white color. Also, the histogram shows that image contains almost equal number of pixels between values ~90 and ~250.

Question 2)



Binary Image: 2a.png



Binary Image: 2b.png

Threshold value is 16 in image 2a.png and 20 in 2b.png and they are calculated by Otsu's Method. By the histogram values, background and foreground weights are calculated. Then, using these weights,

variance is calculated for each iteration of the threshold (between the first and last intensity level of the histogram). The maximum variance value that we have encountered becomes the threshold.

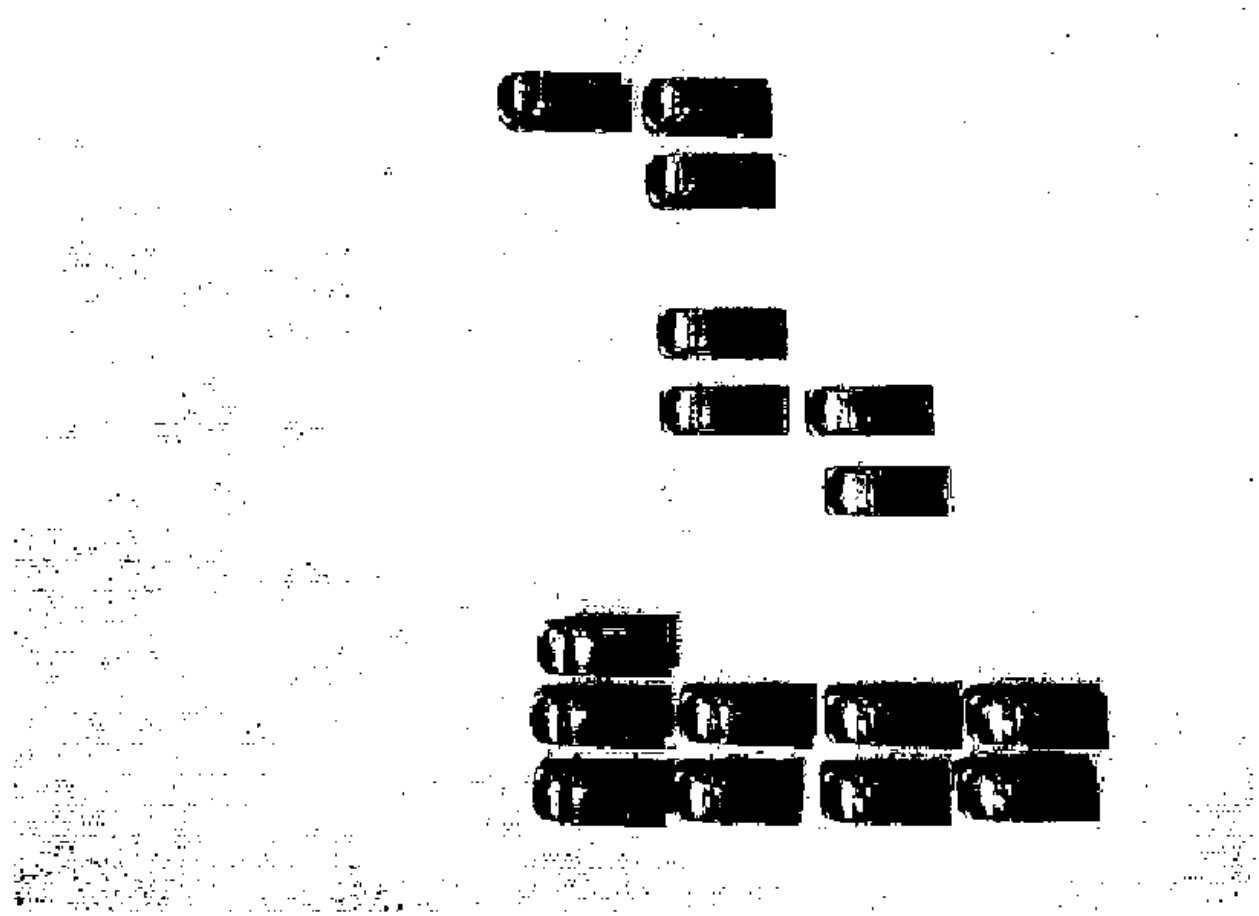
We make the values 0 that are under the threshold value and make the other values 255 which are bigger than threshold value. As a result, since in both pictures the threshold value is approximately in between of start and end of histogram intensity range (range is 0-37 for image 2a.png and 0-45 for image 2b.png), we get half black half white images.

Question 3)

For the dilation of the image, I iterated the structuring element by first putting it at the top left part of the image and when I compared the intersecting pixels (matrix elements), if they have at least one square that they both have value 1, I put 1 to the corresponding pixel of the output matrix.

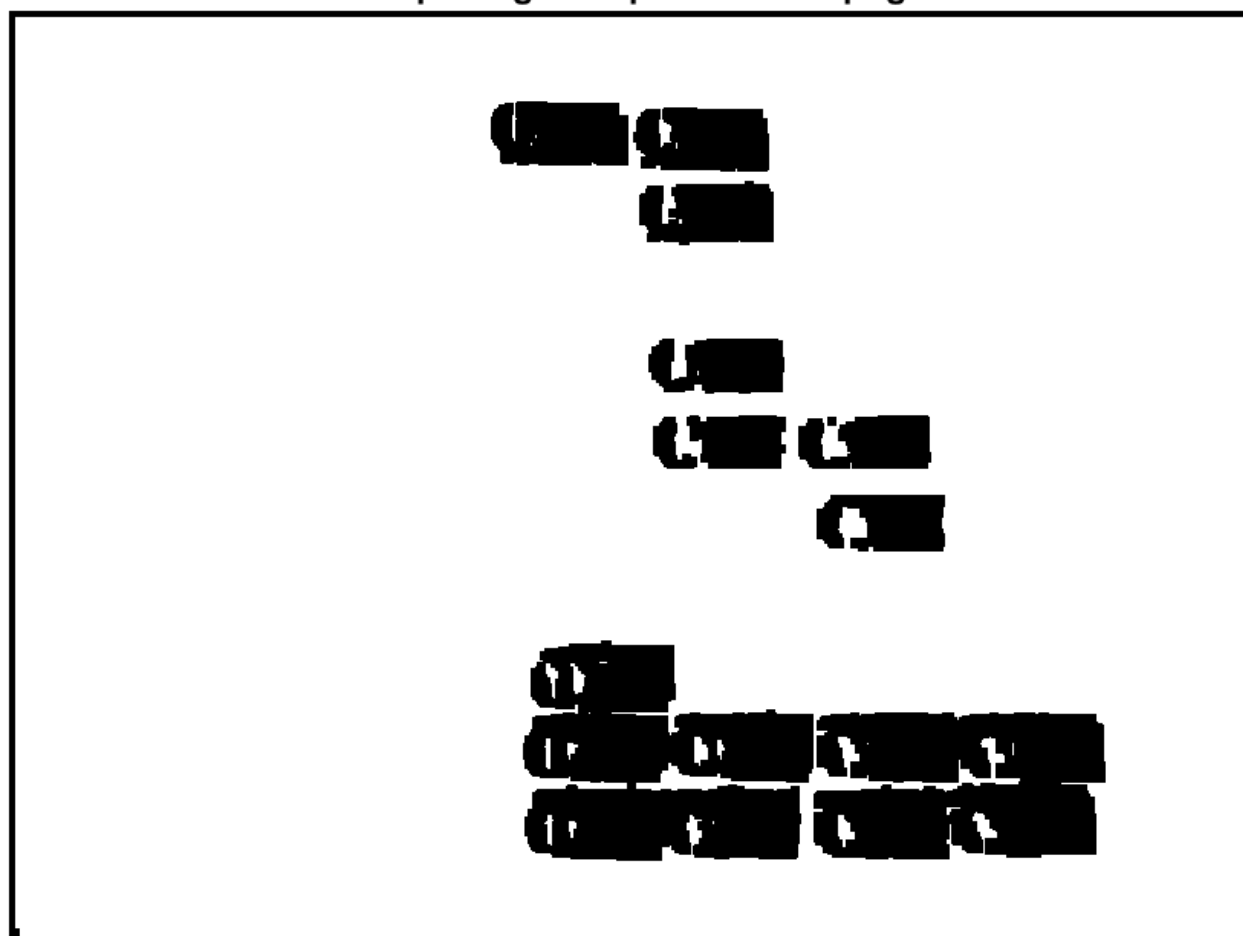
A similar process applies for erosion of the image. Difference is that in the comparison of image matrix and the structuring element, if any one of the neighbors have 0 value, corresponding pixel value of the output matrix is set to 0.

Question 4)

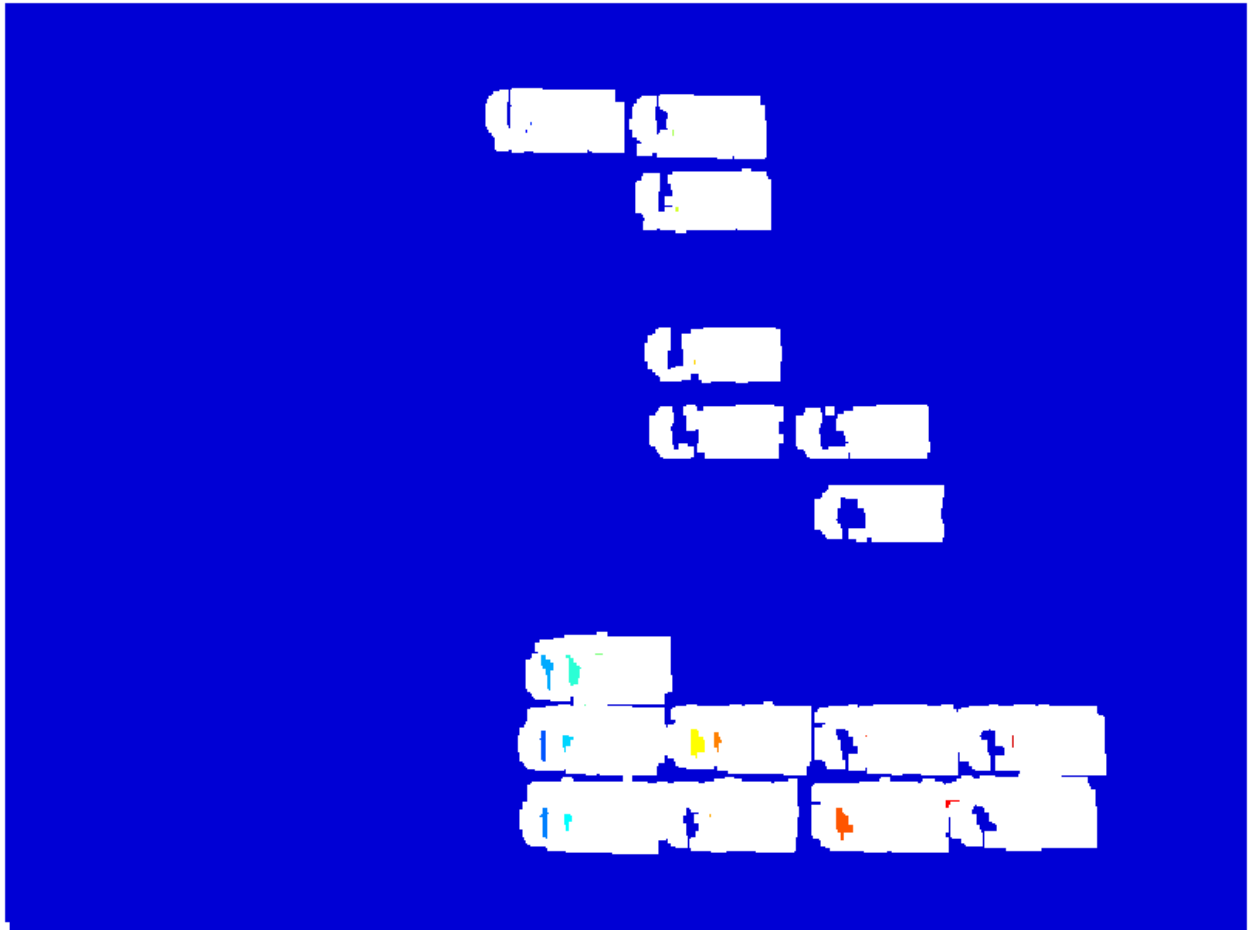


Binary Image: 3a.png

Morphological Opeations: 3a.png



Dilated & Eroded Image: 3a.png



Labeled Image: 3a.png

For the image 3a.png, first I used Otsu's Method to get a binary image of it. Then, I dilated the binary image using a 3x3 structuring element matrix with values 1 to get rid of the noise at the left part of the image. But then the cars were not clear enough so I needed to erode it to make the cars clearer. I used a 5x5 structuring element for erosion because 3x3 structuring element was not enough not clear the white noise on cars. Therefore, it gave a bad labeled image. Also, for a similar reason, I couldn't use a 7x7 structuring element because in that case some cars were collapsing.

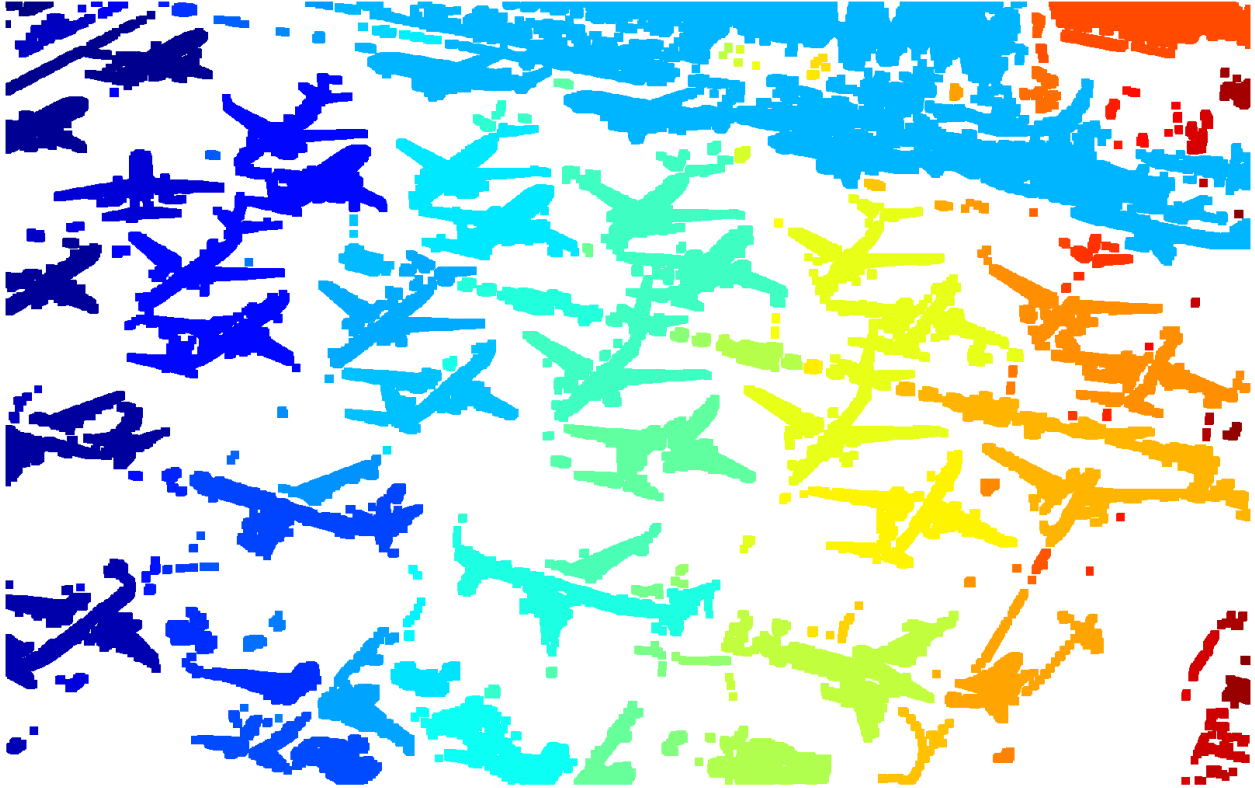


Binary Image: 3b.png

Morphological Opeations: 3b.png



Dilated & Eroded Image: 3b.png



Labeled Image: 3b.png

For image 3b.png, I used one erosion operation with a 5x5 structuring element and six dilation operation with 3x3 structuring element. The challenge was to remove the white lines between planes while not destroying the plane structure very much. After removing the lines with erosion operation, I needed to construct planes with dilation operation. I noticed that using a structuring element bigger than 3x3 gives less accurate results because planes are becoming to look like ellipses.

In the implementation process, I have only had difficulties in the Otsu's Method. Because at first, it was difficult for me to implement a mathematical formula and calculate intensities in a large matrix. I had difficulties with matrix's boundaries. Other than that, I had implemented everything with less difficulties.