Bonus Question

For this assignment, we chose to create a license plate finder.

We will show step by step our algorithm:

1. Read the image:

2. Check the intensity of the image brightness with the function 'mean2' in MATLAB. We check it because we will use the brightness level when we create a binary image.

3. Create a binary image using the 'imbinarize' function. This function creates a binary image from an image I by replacing all values that exceed a suitable threshold with one and setting all other values to 0.

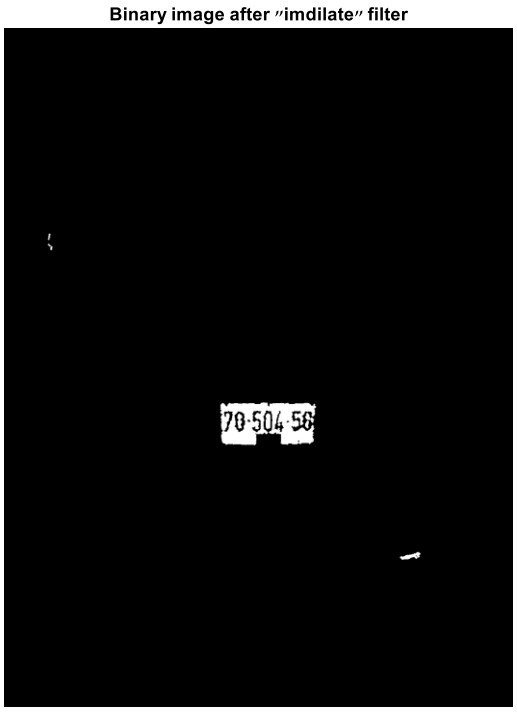
   We chose the 'imbinarize' threshold accordingly to the brightness level of the image. For example, in this image, the brightness level is equal to 0.4541. Thus, we decided to determine a threshold equal to 0.35 for better resolution.

The binary image:

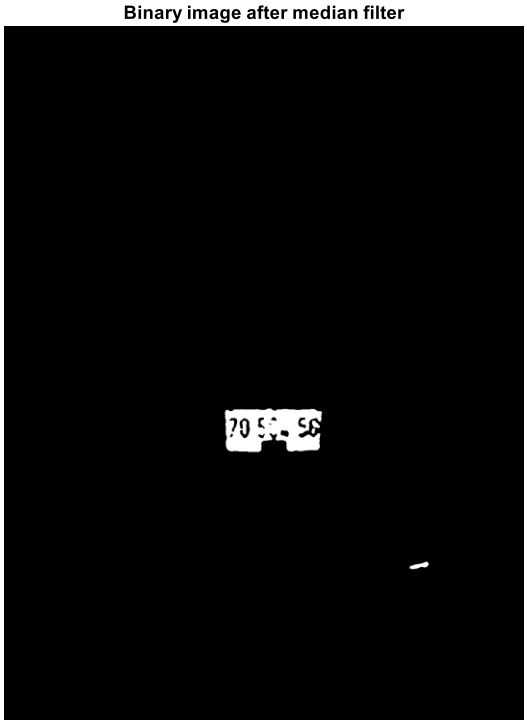
4. Apply a binary mask with pre-determined HSV thresholds – to detect yellow areas (the yellow from the license plate). The result:

The binary image after the binary mask:

5. Now we want to stay only with the license plate. First, we wanted to make the license plate more "filled", so we used the 'imdilate' function. This function dilates the binary image and returns the dilated image, making the license plate more "filled". The result is:



6. Apply the median filter to remove noise and unwanted yellow objects. We chose a kernel size of 10x10. The result is:

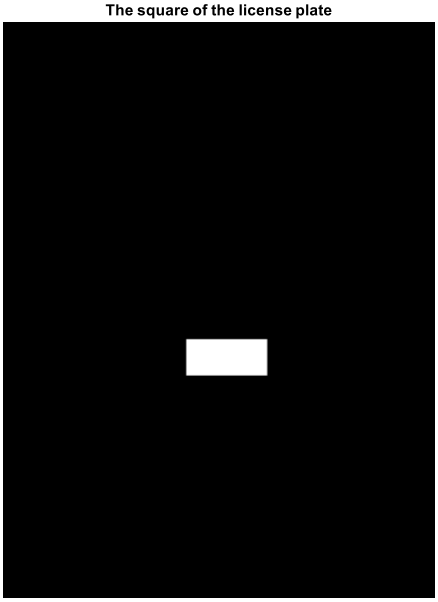


It can be noticed that not all the noise was cleaned.

7. We created a function called 'Check_Where_Plate'. This function receives a binary image and provides the largest white object's coordinates in the image. For example, from the binary image in the previous step, the largest white object is the license plate, and the function's output is the frame coordinates of this plate. We can ignore the little noise in the down-right corner and focus only on the plate by this function.

8. We plotted only the license plate square by the frame that we found in the previous step:

The square of the license plate



9. Show only the license plate colored, and the rest of the image in greyscale:

Only the license plate is colored

10. We did not finish yet. Now we want to focus only on the license plate a little more. We cropped only the frame of the plate:

Image after crop

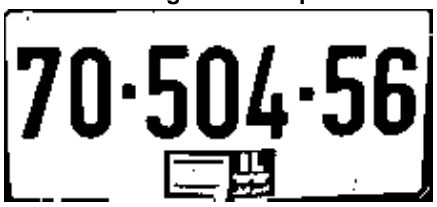
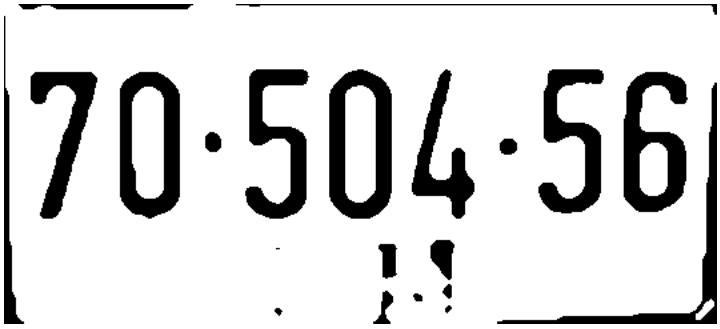


Image after imbinarize function

11. Apply a median filter to remove the little noise from the plate background (kernel size equal to 7x7):

license plate after median filter



12. In our last step, we used the 'bwareaopen' function. This function removes all connected components (objects) with fewer than P pixels from the binary image and produces another binary image.
    We chose P that equal to 500, which will clear all the noise except the plate numbers. Also, we change the color of the numbers and the plate background to make the plate more clearly.
    The result is:

Now what has left is to try to read the numbers using a Neural Network or another good way.

More results:

Original image

Only the license plate is colored

license plate after "bwareaopen" function

Original image

Only the license plate is colored

license plate after "bwareaopen" function