License Plate Detection - Applications of Data Science Coursework

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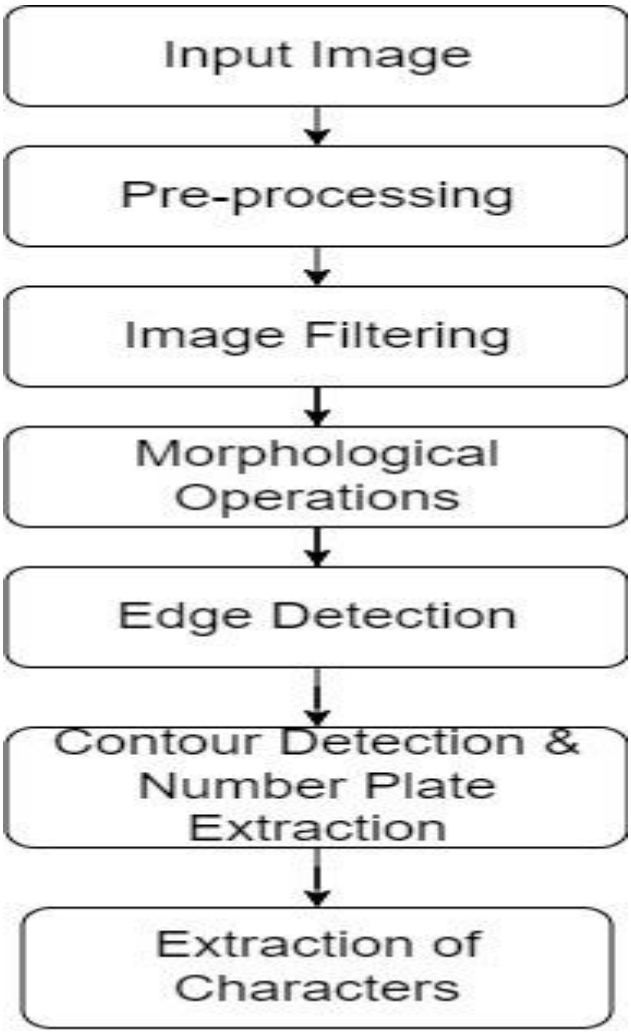
1. Abstract:

With the increase of current population, enormous number of vehicles are increasing daily. It is very important to keep track these vehicles for security aspects. So today we are using computers to store all the vehicles numbers in a database to keep track of every vehicle. At present Automatic Number Plate Recognition (ANPR) technology is the most prominent to detect the number plate. This technology is very useful in controlling the traffic and in any crime detection cases. ANPR technology uses optical character recognition to turn an image of a licence plate into machine-encoded text. The technology can be applied to CCTV, traffic enforcement cameras, and ANPR cameras. Infrared lighting can help cameras capture crisper images. This technology aids in traffic control, and its primary application is security. It aids in the management of undesirable cars in limited regions and zones, as well as in the monitoring of vehicles on the road. So, in our coursework we are going to build an system that takes car image as input and finally it produces the number plate of that car. Due to this license plate recognition we can easily detect traffic violated cars, overspeed vehicles, theft vehicles, crime detection cases .etc. In our coursework we will implement some of the image filtering, image thresholding techniques to enhance the quality of the image thereby performing the OCR technology to detect number plate of that respective car image.

2. Elucidation of Coursework:

1. Flow Chart:



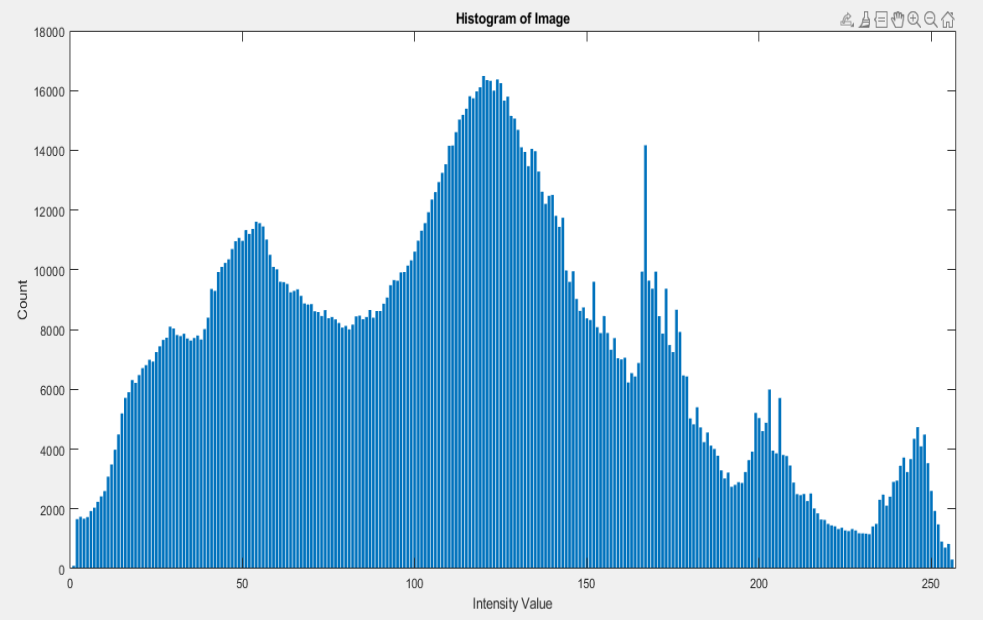
In our coursework we had used the following steps to detect the license plate of a car image. They are:

1. We take the input as RGB formatted image.
2. Here we convert the RGB image to Grayscale image.
3. In this step we are applying Gaussian filter to the grayscale image.
4. In the next step we are applying Morphology process in opening phase.
5. Next we take the output of Morphology processed image as input to thresholding.
6. In this step we will use Edge Detection Canny method for detecting the edges.
7. In the next step we will extract the Contours of the processed image and after that we will extract the Number plate region.
8. In the final step we will extract the characters from the number plate by Optical Character Recognition Algorithm.

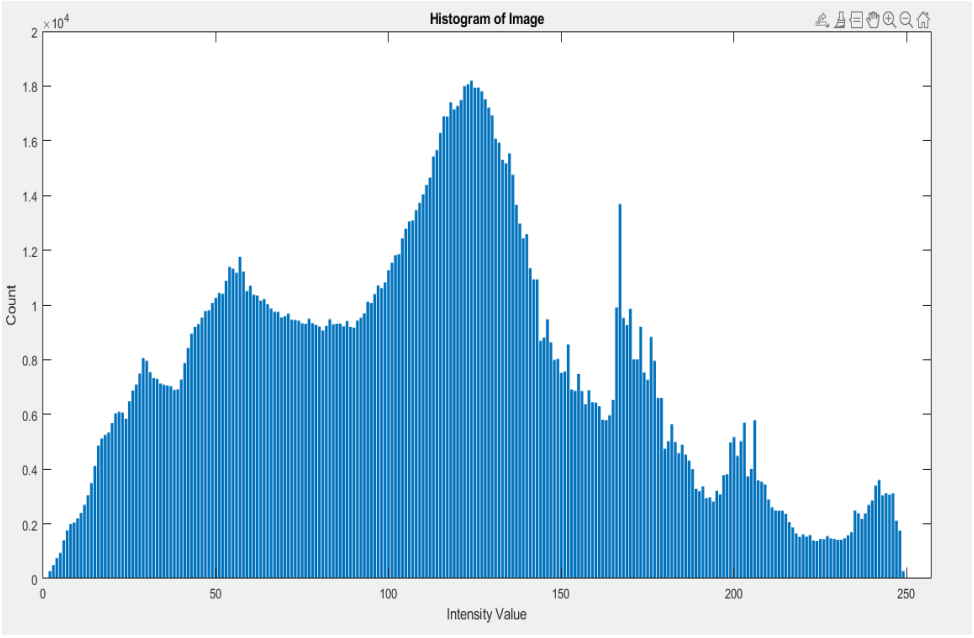
2. Workflow:

For the following coursework we had implemented statistical analysis at each step of the processed image. We used Histogram analysis to evaluate the statistical analysis of image processing techniques. The followings steps describes the step by step procedure of our workflow.

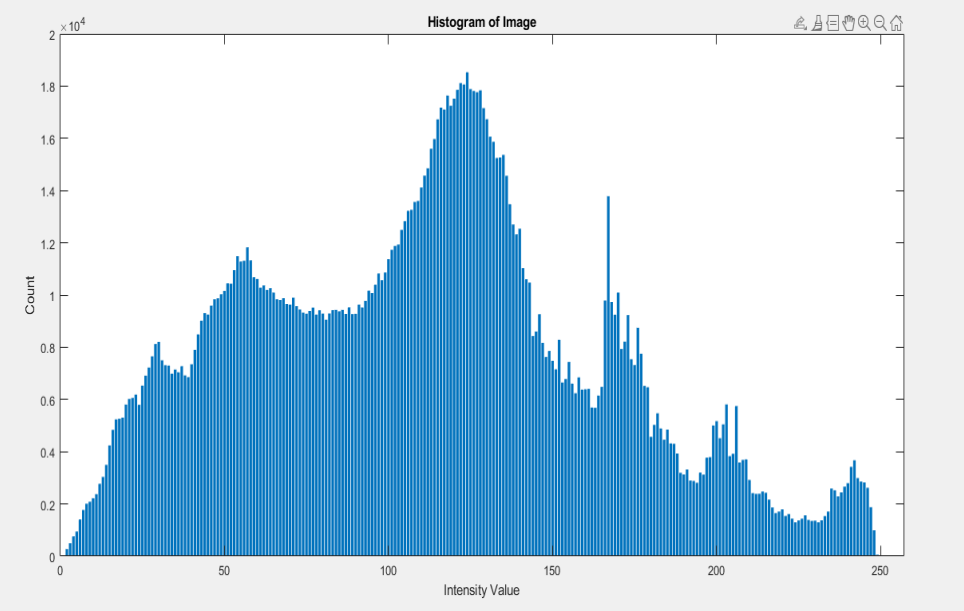
1. **Pre-processing:** In the first step we take RGB coloured image and convert the image to Grayscale image. The rgb2gray function converts RGB images to grayscale by removing colour and saturation while preserving brightness. Below figures illustrates the output of greyscale image and its histogram analysis of greyscale image.


Histogram of Image
Count
Intensity Value
0
2000
4000
6000
8000
10000
12000
14000
16000
18000
0
50
100
150
200
250

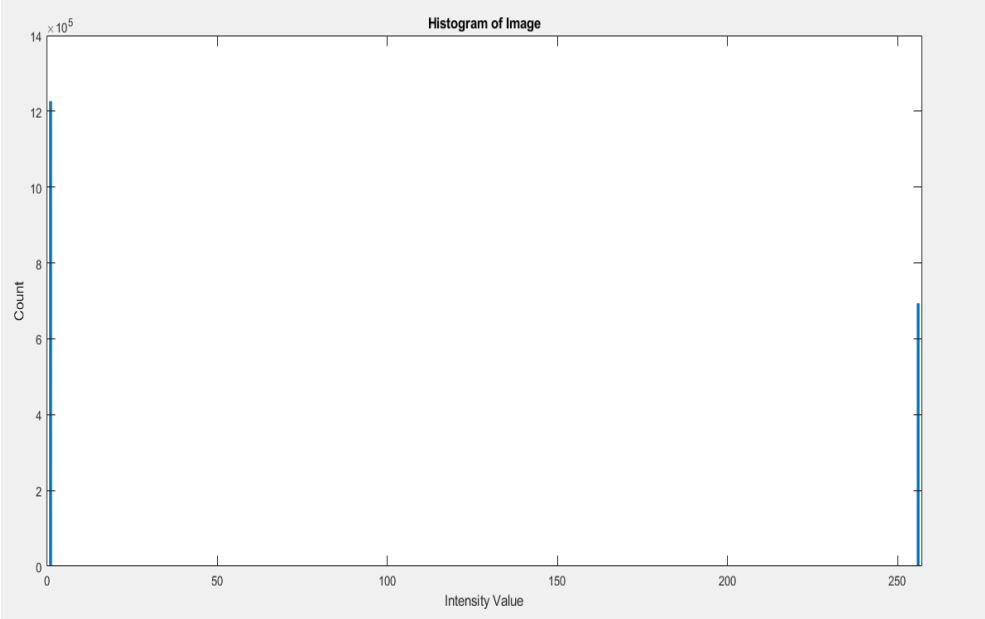
2. **Image Filtering:** Filtering the process of enhancing the features of the image thereby reducing the unwanted features or noises. In our coursework we had implemented Gaussian filtering technique. Below figures illustrates the output of gaussian filtered image and its histogram analysis of gaussian filtered image.



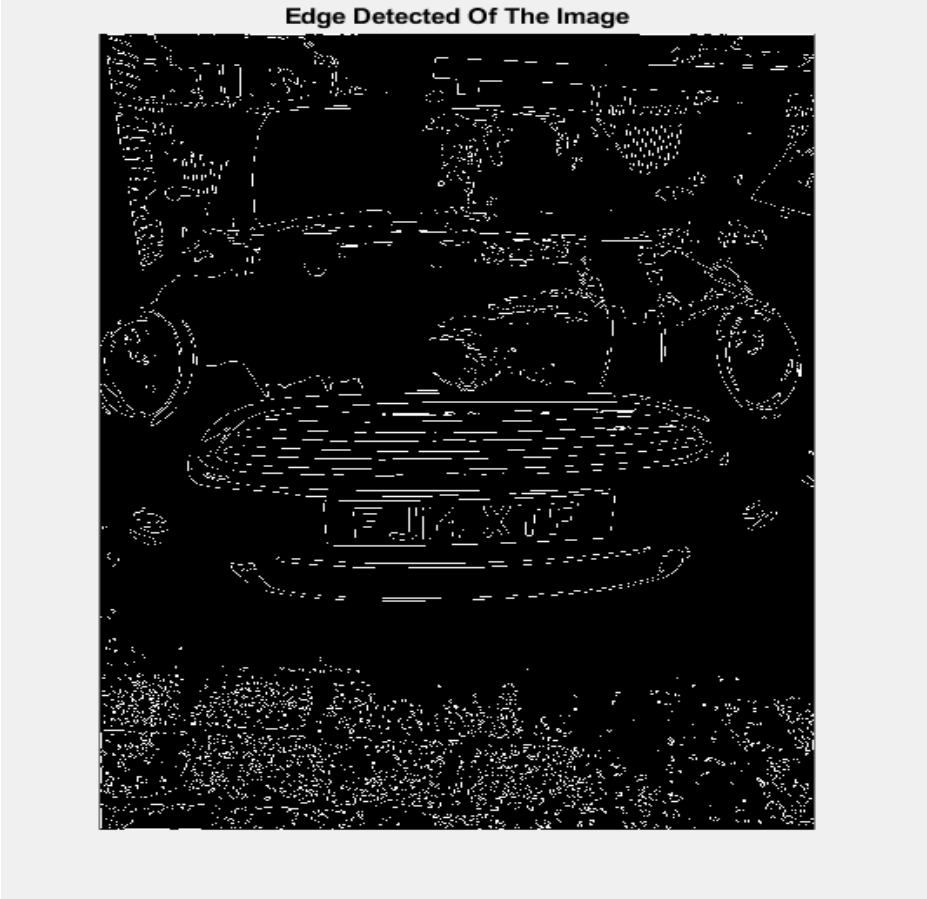
3. Morphological Operation: Morphological operation is the process of applying a structural element to input image to modify the shape of the object. Morphological operation can be done in two ways either by opening or closing. In our case we had implemented opening phase manner where the picture is eroded first and then dilates. Below figures illustrates the output of opening image and its histogram analysis of opening image.

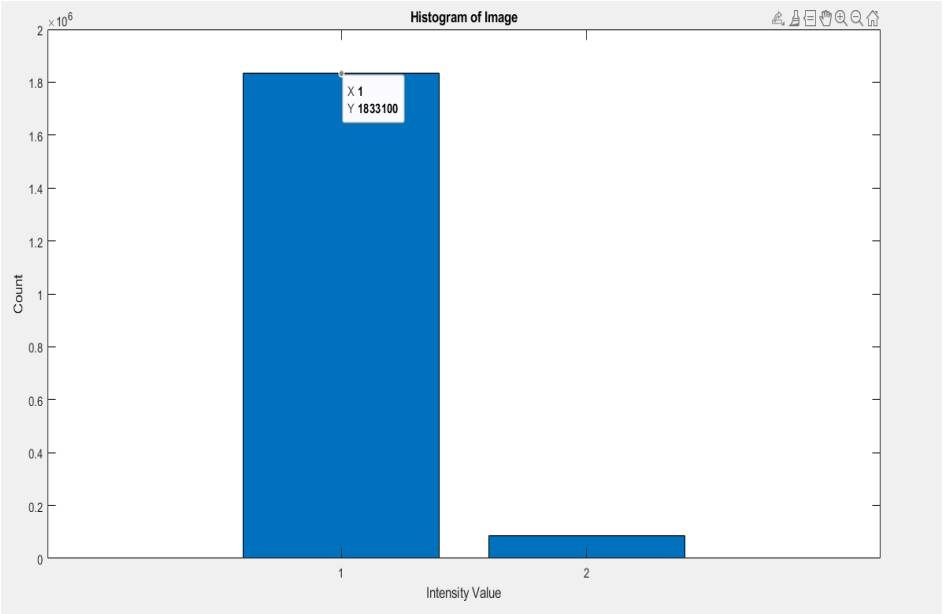


4. **Thresholding:** It is the simplest method of segmenting the images. Thresholding is the process of separating foreground from background. Here we used binarized image technique for thresholding the image. Below figures illustrates the output of binarized image and its histogram analysis of binarized image.

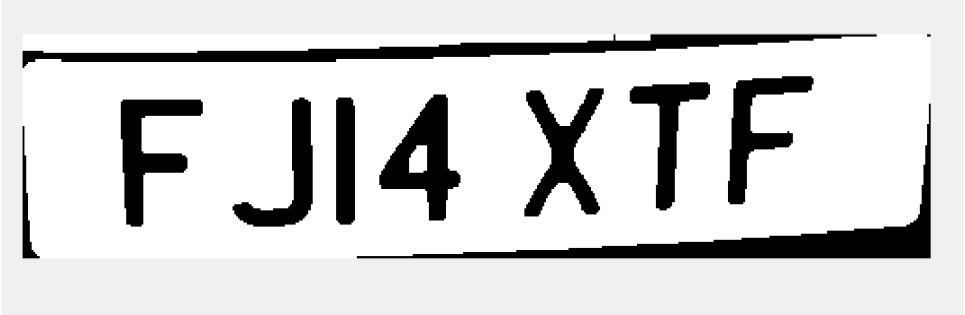


5. **Edge Detection:** Edge Detection is the process of detecting the edges of the image with discontinuities. Here we used Canny edge detection method for our coursework. Its one of the widely used algorithm for edge detection. Below figures illustrates the output of edge detection image and its histogram analysis of edge detection image.

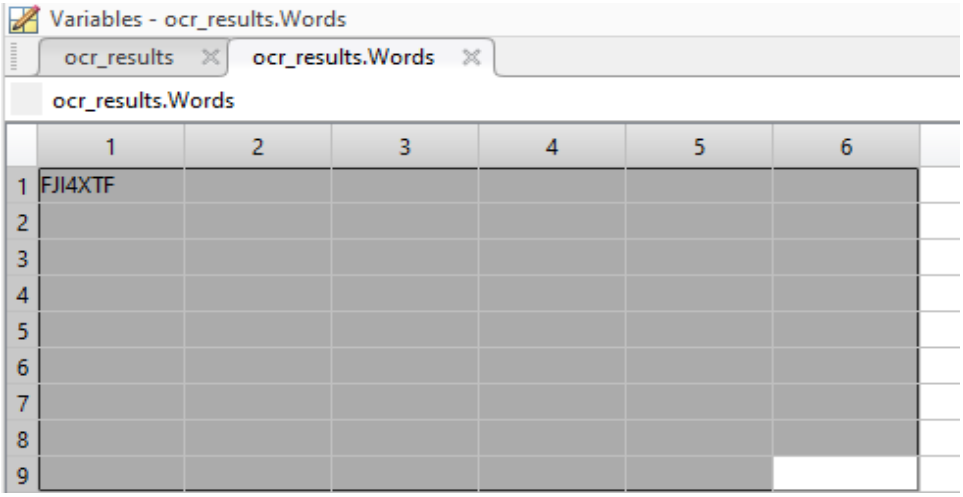




6. **Contour Detection & Number Plate Extraction:** Contour detection is the process of detecting the edges of an object and joining them into an image. We detect the contours of the image using bwboundaries() function. It detects the edges of the image and then we cropped the number plate region of the image to extract the number plate. Below figures illustrates the output of Boundary detected image and number plate extracted image.



7. **Extraction of Characters:** In the final step we used Optical Character Recognition (OCR) machine learning algorithm to detect the characters from the extracted template.



3. Conclusion: License plate detection is entirely executed through Matlab environment. We had used different image processing techniques for obtaining better results. Our system is able to extract and detect the number plate image of an car.

References:

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