S&S Project Report - I
(MATLAB Image Processing to Detect Car's Number)

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Introduction

Our project involves the extraction of text from the number plate of a car with the help of MATLAB. As provided in the abstract, we want to build an automated system that reads the number of a car from the image of the number plate (taken by a camera placed at some particular position for this purpose) and then looks for the same in the institute's database of the registered cars. If a match is found, the gate of the institute opens (with the help of some mechanism that we are not concerned about at the moment), otherwise it stays closed.

The project is based on the generalised idea of extraction of text from an image using the various image analysis tools provided with MATLAB. It involves learning the basics of image and text analysis wherein a significant focus has been given on Optical Character Recognition (OCR).

We have made certain assumptions regarding the image:

1. The image is taken with the help of a camera with a minimum resolution of 10 Megapixels, so that the image is clear.
2. The image mostly consists of the number plate and the region surrounding it and not the complete vehicle.

Theory Involved

There are broadly 3 types of images:

1. Document Images
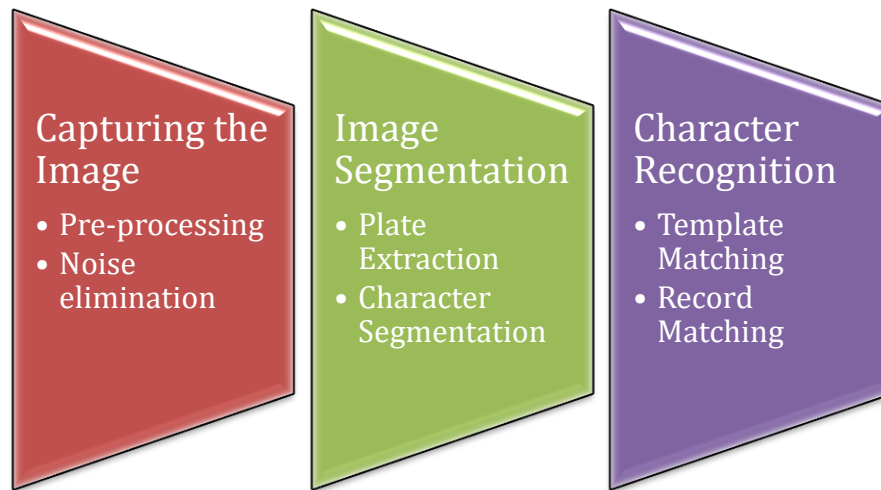2. Caption Text Images
3. Scene Text Images

There are various methods to extract text depending on the type of image we are dealing with. In our project, we shall be concerned about 3rd type, i.e., the scene text images. In these images, we capture a scene using some recording device like camera, and extract the text that is the part of the scene. This text is usually difficult to detect and extract. Following are the reasons for the same:

1. Complex background might make the text indistinguishable.
2. The text might be in various sizes, font styles and colours.
3. Non-uniform lightening, orientation of the image, etc. might make the text not legible.

Techniques are available that will help us in achieving our goal. These techniques have varied benefits like some provide a better solution for uneven orientation of the text in the image, while others provide a solution that is insensitive to the light falling on the image. In our project, we incorporate some of these techniques as per our requirement and benefit.

Procedure (Tentative)
The process can be divided into 3 broad steps as shown in the flowchart below:

Capturing the Image
- Pre-processing
- Noise elimination

Image Segmentation
- Plate Extraction
- Character Segmentation

Character Recognition
- Template Matching
- Record Matching

Capturing the Image:
Pre-processing: Here, we convert the image into gray scale. This is required as we cannot identify important edges in a coloured image. Moreover, converting an image into gray scale reduces the complexity of the image.
Noise Elimination: There are various types of noises present in an image – salt and pepper, Gaussian, blurring of image, etc. We need to ensure that these noises are eliminated from our image in order to retrieve the text optimally. So, following noise reduction techniques are employed:
1. Median operator (to reduce salt and pepper noise)
2. Weiner Filter (to reduce Gaussian noise and blurring of image)
3. Morphological Filter (to enhance the character recognition)

Image Segmentation:
Plate Extraction: The number plate is cropped from the rest of the image. Then we apply some edge enhancement techniques like Sobel operator, etc.
Character Separation: We, then, separate the characters out of the image. This is done on the basis of the height of the characters assuming all the characters in a number plate have the same height.

Character Recognition:
MATLAB provides various tools to recognise the characters. E.g. it has `ocr()` method that recognises the characters and saves them in an array.

Progress So Far
So far, we have tried edge detection and noise reduction filters on different images of number plates of different sizes and orientation. We found that the image contains the characters of the number plate outlined in white on a black background. Depending upon

the distance from which the image has been taken, the image might be cropped to get good view of the number plate and remove any unnecessary surroundings/details. Character separation and recognition are yet to be done.

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