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# Extraction of Features in Number Plate using Contour Spotting

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## Abstract

This Number plate recognition (NPR) of a vehicle's become very important nowadays. Also, it isn't easy to verify the car's owner. They drive very fast and violate traffic rules. Identification of owners and traffic control is a crucial problem in every country. In every city, 90% of people own their vehicle, so it becomes challenging to trace every car; many examples include tracking stolen vehicles, managing the toll barriers, parking tolls, infringed traffic lights, and monitoring. Because our police officers may not be able to catch the cars due to over speeding and occasionally the number plates appear dirty, it is difficult to apprehend everyone and punish them. That is why it is essential to develop NPR to solve all these problems. ANRP is in a large amount and several in numbers. Yet, it is a challenging task because of the diversity in number plates, different colours, different languages, and different characters; also, people may place non-standard types of plates in their vehicles and illumination during image acquisition. In this paper, we introduced NPR using some algorithms, different morphological operations, image size, character segmentation and contour spotting methodologies for plate pinpointing. An Artificial Neural Networks is used for recognition and character classification. An extension and future trends of NPR are suggested at the end of the paper

**Keywords.** Number Plate Recognition (NPR), Character Segmentation, License Plate (LP), Artificial Neural Networks (ANN), Image Processing, Machine Learning, Technologies.

## 1. INTRODUCTION

Energy In the last few years, license plate recognition (LPR) has been one of the practical advancements for vehicle superintendence Automatic number plate recognition (ANPR) is widespread surveillance that photographs moving targets and deciphers their license plates. An ANPR system can be used for various purposes, Automated traffic monitoring and tracing, toll collecting for park and highways, fuelling store automated, and trip time monitoring. A growing amount of traffic flow analysis using ANPR is done to support

smart mobility [1]. The fundamental justification is that, in contrast to Ultra High Frequency Radio Frequency Identification systems [2], ANPR system identifies registered number plate with no additional [3]. Modern ANPR cameras can scan license plates and provide other relevant data like counting, direction, groups of cars, and speed. The ability of ANPR technology to detect and browse many moving vehicles has led to its integration into many areas of the current digital landscape. To offer an exact way of contemplating a vehicle without earthing intercession. It is used for a variety of services, including access control, parking management, tolling, user billing, delivery tracking, traffic management, policing and security services, customer assistance and instructions, red light and lane imposition, cavalcade stretch guesstimate, and numerous others [4]. The prime focus of this paper is to locate regular licence plates, segment characters, and identify them from a car image. Different scales, distances, angles, resolutions, and lighting requirements must be accommodated by the system. The problem statement will be presented in Section 2. The suggested solution will present in Section 3. The paper is finally concluded in Section 4.

### ***1.1. Related Work***

Researchers may have discovered various techniques for locating license plate inputs and neural networks. Rodolfo and Stefano developed an approach based on vector quantization in 2000. (VQ). In this system, they provide suggestions about picture regions, and by this, they improve location performance. By coding Mechanism, VQ image representation was explained. Neural networks were employed by Park et al. (1999) to locate license plates [5]. HSI values are used as filters to determine whether each small window of an image contains a license plate. A post-processor then combines these filtered images and finds the bounding boxes of license plates in the picture. Zimic et al. in 1997 located license plates by fuzzy logic. In This logic, some functions were made for the vague as “Dark and bright sequences” [6] But due to its sensitive role, it needs a lot of time for processing. In 2002, Zhu et al. and Wei et al. in 2001 used the colour feature to locate the plate, but this was not enough for different environments. Again, Ming et al. (1996) improves the edge detection method by eliminating the lowest and highest parts of edge density to simplify the complete image. But some parts of the plate will be lost in this method.

### ***1.2. How actual ANPR works***

One of the most precise uses for computer vision systems is ANPR. Autonomous number plate recognition systems use visual character recognition (OCR) to detect car licence plates. Webcams quickly capture number plate scans, and software is then used to segment, confirm their order, and convert the image to text.

1. Initially, the ANPR camera records photos with a licence plate (video stream or image).
2. The plate is then located using machine vision techniques (object detection).

### ***1.3. Applications of ANPR works in real life***

We offer a robust actual ANPR framework that is meticulously working on CCTV video footage received from cams that are not explicitly set up for ALPR. The current ALPR algorithms are predicated on the idea that the input video will be captured using a specialized, high-resolution, high-speed camcorder and is/or assisted by controlled capture surroundings, with the best camera height, focus, activity speed, and lighting settings [8].

Furthermore, typical video forensic applications could call for looking for a car with a particular licence plate on noisy surveillance video released by unspecialized, medium- to higher cameras operating in low-light scenarios [9]. Border patrol: The identification number is registered at the country's entryways and used to trace border crossings. Signalization: Relying on the cars' entry permit, the traffic can be routed to multiple lanes. The technique lessens both the number of stewards and road congestion. Analysing the travel time: Officials use journey time analysis (JTA) as a powerful instrument to track passage through vehicles and the length of time they take to go from one node to the other. Also, these statistics help congestion managers plan their routes more precisely [10].

## 2. PROPOSED METHODOLOGY

We find a different solution for character recognition and image segmentation for the LPR framework. We have used three stages to identify these kinds of frameworks. The license plate region must first be located and extracted from a larger scene image. Then, starting from the area of the license plate, the alphanumeric characters on the license plate must be separated from the background. In the third step, send them to an OCR system for recognition. To successfully identify an automobile by reading its license plate, finding the plate in the scene image provided by any acquisition device is crucial (e.g., video or still camera) [7]. ANPR Required four major stages to complete their process that is shown below in Figure 2.1.

Pre-processing, NPR (Number Plate Recognition), Segmentation of Characters, Recognition of Characters

### 2.1. Pre-processing

The automatic number plate identification system has numerous difficulties. To improve the input image and make it more suited for the following processing processes, this step is crucial. Pre-processing starts with applying a minimal filter to the image to improve the dark values by expanding their region as shown in Figure 2.1.



Figure 2.1. A car picture with Number plate which we are going to detect below.

This step increases the image's saturation to improve colour separation [16]. The idea is then changed from colour to grayscale. Then, to separate the background from highlights, we increase the image contrast.

### 2.2. License Plate Recognition

The output of this stage will be a sub-image that includes the license plate because the location of the license plate is in this stage [4]. This process involves essential steps like the Exact location of the Number Plate and finding large rectangles around the Number plate.

### 2.3. *Segmentation of Characters*

Exact location of the Number Plate and finding large rectangles around the Number plate. To segment, a picture is divided into smaller portions for further processing. Such as - Line level segmentation, word level segmentation [13], and character level segmentation are the order in which images are segmented

### 2.4. *Recognition of Characters*

Computers can recognize written or printed characters, such as numbers or letters, and convert them into a format that the computer can use through a process called character recognition [14].

## 3. GENERAL PROCESS OF ANPR SYSTEM

Using a camera to recognise licence plates requires taking images of the target scene's licence plates. After taking a high-quality photo of the surroundings or the car, any ANPR system's essential dependence is on its algorithms' trustworthiness [11][12]. Tens of thousands of lines of software coding are required for these algorithms to provide the desired results and manage the system complexity.

### 3.1. *Python ANPR with Open CV and OCR*

Firstly, Let's Understand the term OpenCV [18] and OCR sing a camera to recognise licence plates requires taking images of the target scene's licence.

**"Optical Character Recognition" (OCR):** "Optical Character Recognition" It is a piece of technology that can discern text in digital images. A real paper document or an image can be turned into a text-rich, readable electronic version using OCR software. Other OCR technologies may transform the characters into editable text back right in the image, while some merely export the text [17, 18]. Mainly we must follow 6 steps for Detect a number plate:

- Import after installing dependencies.
- Image blur, read in grayscale.
- Track down the localization edges.
- Then, place the mask over the contours.
- To read text, use simple OCR.
- Outcome of Rendering

### 3.2. *Read the image, Grayscale and Blur*

To read in our image and perform some Gray scaling, we have used the open cv imread function shown in Figure 3.1.



Figure 3.1. Output after using Gray scale on original image

### 3.3. Apply Filter and find the edges for localization

The next thing that we're going to do is apply a little bit of filtering and some edge detection, so our filtering will basically allow us to remove noise from our image. As shown in Figure 3.2

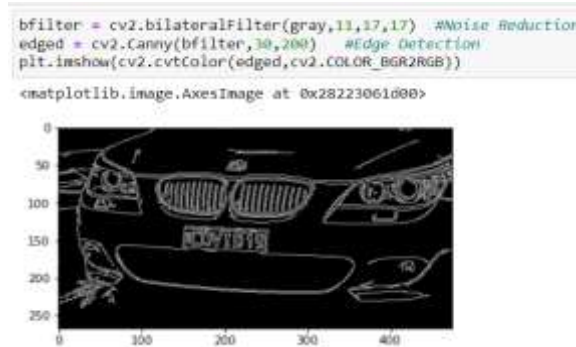


Figure 3.2. Output after using Gray scale on original picture

To do so, we've used the Canny algorithm [14], which allows us to detect edges; here again, we've got several parameters that we can pass through, which can be tuned depending on what you find works.

### 3.4. Find Contours and Apply Mask

The next step that we must complete is contour detection, which entails locating these lines and locating polygons within those lines [15]. Ideally, shapes should be visible in our images because a rectangle is most likely going to be the shape of our license plate. We are looking for a contour with four points. The ideal result for our number plate portion is a contour with four points. In the next line we have grabbed our contours using `imutils Grabcontours()`, this basically simplifies how our contours are returned.

### 3.5. Masking the image

The next thing that we're going to do is apply a contour search, we've accurately detected where our number plate is located. The next step is to just isolate this numberplate portion because doing so will make it much simpler to feed the data to easy OCR as shown in Figure 3.3. The next thing that we're going. To achieve so, we first started by identifying every single portion of our image that isn't black.



Figure 3.3. Output After Masking the original image

After clipping the image, we are putting those in variables x and y and obtaining a set of coordinates that reflects every section's now visible in numberplate shown in Figure 3.4.

```

i: (x,y)= np.where(mask==255)
   (x1,y1)=(np.min(x),np.min(y))
   (x2,y2)=(np.max(x),np.max(y))
   cropped_image= gray[x1:x2+1, y1:y2+1]

i: plt.imshow(cv2.cvtColor(cropped_image, cv2.COLOR_BGR2RGB))
i: <matplotlib.image.AxesImage at 0x28223127730>

```




Figure 3.4. Output of the number plate

As a result, when everything is put together, we have our cropped image, which represents our number plate. MNIST dataset is used for character recognition, and ANN ( Artificial neural network) Classifier is used to check the accuracy of our number plate.

#### 4. CONCLUSIONS

Using It is well known that now days there are infinite IOT things through which one can capture an image, but how to utilize these things for the security should be of concern. ANPR should also be utilized in such appliances which can give a shorthand to security and help the people. Through this paper we have seen how to locate regular licence plates, segment characters, and identify them from a car image which will help a lot for security purposes but there are some difficulties that still needs to be resolved:

- Dark shaded portions at night
- Hiding numberplate with Infrared Light so that camera cannot capture the image
- Bright light emitting by plates

The algorithm is good to go but all these factors may affect the image capturing process which is the basic need of the algorithm. Also, we have seen how old methods were helpful for the numberplate recognition but keeping the above shortcomings in mind a new technique and appliances should be developed so that there is no act of hindering the detection system.

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