COMPUTER VISION REPORT

AUTOMATIC NUMBER PLATE DETECTION AND RECOGNITION

GROUP 7

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CONTRIBUTION (In the order of Workflow)

1. SIDDHARTH PANDEY - Image Grayscaling and Maximize Contrast
2. ATHARVA DESHPANDE - Adaptive Thresholding and Finding Contours
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ABSTRACT

Manual monitoring of traffic rule violators in a populous country like India is a challenging task. Our aim is to design and develop a real-time license plate detection system that will work efficiently, adapt to different traffic environment conditions, provide robustness against progressive or sudden illumination changes, occlusions & detection time of the system should be as short as possible.

MOTIVATION AND CHALLENGES

Automatic Number Plate Recognition (ANPR) can help by recognizing the registration number of the vehicle in an efficient manner. It can be applied at a number of public places for fulfilling some of the purposes like traffic safety enforcement, automatic toll tax collection, car park system and Automatic vehicle parking system. Some of the challenges that we face in the process are -

- Physical Feature Variation
- Multiple Plates or Similar Patterns
- Uneven Illumination
- Partial Obstruction
- Camera Mounting Variations

LITERATURE REVIEW

Title	Authors	Year	Objectives	Approach	Strengths	Limitations
Automatic License Plate Recognition System for Vehicles Using a CNN[4]	Yogesh Kumar, Parneet Kaur, Shakeel Ahmed, Abdulaziz Alhumam, Ruchi Singla and Muhammad Fazal Ijaz	2021	(1) To study existing methods of character segmentation and recognition and various pre-processing techniques available. (2) To improve the quality of images taken from input sources using pre-processing methods and to extract the region of interest. (3) To use efficient deep learning techniques and recognize license plates with a good accuracy	Acquiring an image, pre-processing, applying thresholding on the image, masking, training the model, and performing the classification	1. The system works efficiently in night mode 2. High recognition rate of 98.13% for a total of 160 images 3. Works on more than one vehicle type 4. Detects license plates that have various fonts	1. Recognition of multiple license plate in an image 2. CNN cannot distinguish between the plate area and the grills of a motor vehicle

License Plate Recognition System Based On Contour Properties and Deep Learning Model	Md. Zainal Abedin, Atul Chandra Nath, Prashengit Dhar, K.Deb, Mohammad Shahadat Hossain.	2017	(1) To develop an algorithm for the detection of vehicle license plate by using contour properties and recognition based on a DL model (2) Detection based on morphological processing & Gaussian smoothing, adaptive thresholding and filtering contour properties of the characters in the lower part of the plate (3) Recognition based on a multilayer CNN DL model	Detection of a plate based on contour properties of the characters of lower part of a plate and the recognition being performed by deep learning approach named convolution neural network	1. High detection accuracy, segmentation and run-time efficiency 2. Can process images in a variety of conditions such as rainy, rotated, different illuminations and low contrast	1. Limited to detection of plates on cars. Should work for other vehicles. 2. Night mode detection 3. Low detection rate

METHODOLOGY

In this section, we will briefly describe the method used for the algorithm. A brief description is as follows -

A. Maximize Contrast
B. Adaptive Thresholding
C. Finding contours
D. Select boxes based on character size and arrangement of contours
E. Finding contours on cropped boxes to get individual characters
F. Use a trained CNN model for recognizing characters

A.) Maximize Contrast

The image is converted to grayscale for better localization. Then we use two techniques - Opening (Foreground Erosion followed by Dilation) and Closing (Foreground Dilation followed by Erosion) to remove foreground and background impurities. It also creates a contrast between the two images for better detection.

B.) Adaptive Thresholding

First of all, the image is smoothened using a 5x5 gaussian kernel. Images can contain instances of variable illumination and intensities, and a global threshold value is unsuitable for such cases. Therefore, we assign a different threshold value to each subset of pixels (19 x19 in our case). This helps in overcoming the challenge.

C.) Finding Contours

Contours are defined as the line joining all the points along the boundary of an image that are having the same intensity. They work on binary images, therefore thresholding techniques were used.

D.) Filtration of Contours

The image will have several contours, and we need to select those contours which have the characters of the license plate. We first draw boxes around each contour, and apply two criterias on these boxes. First, the boxes should be within a predefined threshold, since license plate characters have a fixed size. Second, a license plate has consecutive characters, so those boxes will be selected which are located next to each other.

E.) Finding Individual Characters

Next, we rotate the entire image in such a way that the license plate is in a horizontal position. Once again, adaptive thresholding and contour detection is performed, and the selected collection of boxes is cropped individually.

F.) CNN Model

We train a Convolutional Neural Network model on the 'alpr-character' dataset for optical character recognition. We feed the cropped image to the model, and obtain a character prediction for the same. We use this model to obtain the characters of our selected boxes, and order them to form the license plate. Other OCR models like pytesseract and Google vision can be used for better prediction as well.

DATASET

The dataset we are working on consists of a total of a 160 wide range of images whose features cover all the real-life challenges that help train the model efficiently. Salient features of the images in dataset include:

- Multi-line plates (i.e plates having more than one line of characters)
- Tilted or Skewed License Plates
- Number Plates captured at night (to enhance night mode detection of system)
- Multi-Font License Plates (includes coverage of indic scripts)
- Number plates of different vehicles

EVALUATION METRICS AND ANALYSIS

Our task is to perform license plate recognition, and for that, we use the classification accuracy as the evaluation metric. This is because the model should predict the exact license plate number, and partial correct predictions are still useless. So, we use the accuracy evaluation metric. Now, for our chosen dataset, we obtained an accuracy of 82.5%, ie, 132 of 160 samples were classified correctly.

EXPERIMENTAL RESULTS

Experiments have verified that the algorithm is robust to all types of images and performs well on the hybrid dataset with an accuracy of 82.5%. Since the dataset contained samples from various distributions like, rainly, night, snowy, different camera orientations, etc, this score proves that finding contours for license plate recognition is worthwhile.

CONCLUSION

After working on License Plate Detection, we found that detection of license plate is based on contour properties of the characters is a relevant method. We also performed character recognition by a CNN model and evaluated our method on captured images in different scenarios.

REFERENCES

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