AUTOMATIC NUMBER PLATE DETECTION OF VEHICLE IMAGES USING CONTOUR DETECTION

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Abstract: Automatic Number Plate Recognition (ANPR) is an image processing technology which uses number plate to identify the vehicles. Number plate is a plastic or metal plate in a rectangular shape which consists of a unique combination of numeric or alphanumeric identifier. The objective is to localize the number plate on a vehicle. The development of this system includes two stages which are image pre-processing and localization. The system first detects the vehicles and then captures the vehicle image. Vehicle number plate region is extracted using the image segmentation in an image. The proposed algorithms is implemented and simulated in Java and use several approaches such as noise reduction, grayscale conversion, edge detection and contour. The evaluation of the performance system is tested with a number of vehicle images from reliable sources.

***Keywords*:** Number plate, Image processing, Java, Edge Detection, Localization

1. INTRODUCTION

Automatic Number Plate Recognition (ANPR) has become a powerful automated technology and system that has a wide range of applications, especially in today's modern world. Day by day the rate of growth for automobiles keeps increasing as it has become a mandatory necessity for the majority of people. ANPR is an image processing technology used to recognize vehicles by identifying the number or license plates. ANPR can be utilized for a variety of purposes including speed enforcement, parking lot and vehicle surveillance. This system can also be used to identify and deter a wide range of criminal actions as well as to maintain security in highly restricted locations such as military zones or regions surrounding important government offices. Therefore, this ANPR system has become an extremely important and useful tool for vehicle surveillance. In this study, we will offer a method by using edge detection, noise reduction, morphological operations and character matching that can deal with different input images such as angles, distances, sizes, resolutions and illumination conditions.

2. METHODS

IMAGE ACQUISITION

The data collected for this work consists of vehicle images. Specifically, 97 vehicle images were obtained from dataset that is prepared by Ondrej Martinsky.It is colored jpeg images and 10 images are used for system testing.

Figure 2.1: dataset of image

IMAGE PRE-PROCESSING

I. **NOISE REDUCTION**

Median filtering is very useful in reducing impulsive or salt pepper noise. It preserves edges in an image while reducing random noises. In a median filter, a window slides along the image, and the median intensity value of the pixels within the window becomes the output intensity of the pixel being processed.

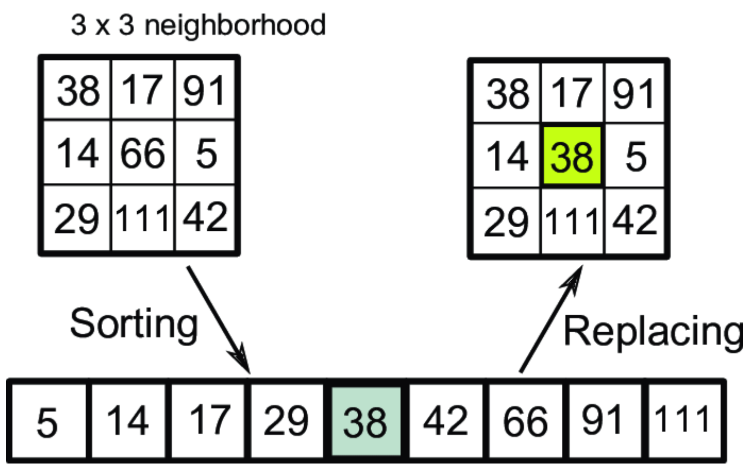

Figure 2.2: Theory of median filtering

Figure 2.3: Original Image

Figure 2.4: Filtered image

II. GRAYSCALE CONVERSION

The luminosity approach is an advanced variation of the average method. It averages the results as well, but it does it in a weighted manner to accommodate human perception. Because we are more sensitive to green than other hues, it is given the highest priority. The brightness formula is 0.21 R + 0.72 G + 0.07 B.

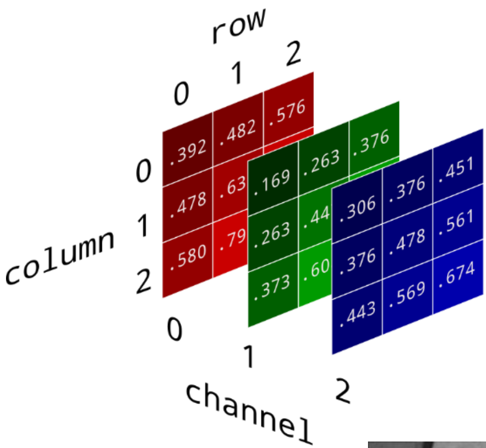

Figure 2.5: Filtered image

Figure 2.6: Grayscale image

III. EDGE DETECTION

In this paper, we will extract the edges of plate number by using Sobel operators for detection of edge gradients. The pattern of vertical edges remains in conformity with the pattern of license number. The vertical edge at point(x,y) is found using the following formula stated by Satadal Saha etal.,[6] in (3):

$$gradV\ (y,x) = \sqrt{\left(\sum_{m=-1}^{+1} \sum_{n=-1}^{+1} V\_mask\ (n,m)\ img\_contrast\ (y+n, x+m)/4 \right)^2} \tag{3}$$

where, img_contrast is the enhanced image over which the edge detection algorithm is operated upon, V_mask is the sobel's mask for vertical edge detections given below

$$V\_mask = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix}$$

Figure 2.7: Grayscaled image

Figure 2.8: Edge detected image

IV. BINARIZATION

Otsu thresholding method works by Iterating over all conceivable threshold values and calculating the measure of a spread for the pixel levels each side of the threshold. For example, differentiating the pixels that either fall in foreground or background. The goal for using this method is to obtain the least threshold value for the total foreground and background spreads.

Figure 2.9: Edge detected image

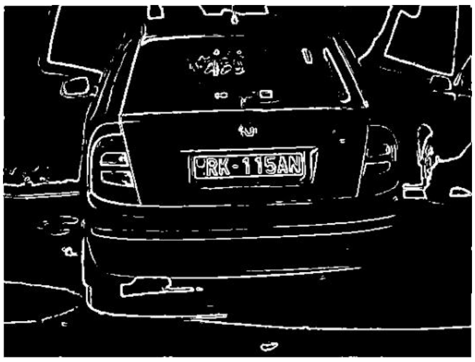

Figure 2.10: Binarized image

V. CONTOUR DETECTION

Localization is done by contouring. Contour is a closed curve joining all the continuous points having some color or intensity, they represent the shapes of objects found in an image. Contour detection is a useful technique for shape analysis and object detection and recognition. After performing edge detection and binarization, we find the points where the intensity of colors changes significantly and then we simply turn those pixels on. However, contours are abstract collections of points and segments corresponding to the shapes of the objects in the image. As a result, we can manipulate contours in our program such as counting number of contours, using them to categorize the shapes of objects, cropping objects from an image (image segmentation) and much more.

Figure 2.11: Binarized image

Figure 2.12: Top Contour Image

Figure 2.14: Plate Number

Figure 2.13: Plate Number Contour

3. FINDINGS AND ARGUMENTS

We tested our proposed algorithms on 30 images from the dataset manually to validate the accuracy and its performance. This is the formula we used to obtain the localization accuracy: -

$$Localization\ Accuracy = \frac{Number\ of\ detected\ vehicle's\ plate}{Total\ number\ of\ input\ images}$$

Table 3.1 Result

Experiment	Successful Detected Vehicle's Plate	Localization Accuracy
Result	13/30	43.33%

Our proposed algorithms failed to localize the vehicle's plate for 56.67% of the dataset. This happened due to some factors that might affect the program to recognize the number plate such as the angle, backgrounds, false edges, obstacles and others. Below are the results for the successful and failure to recognize the number plate.

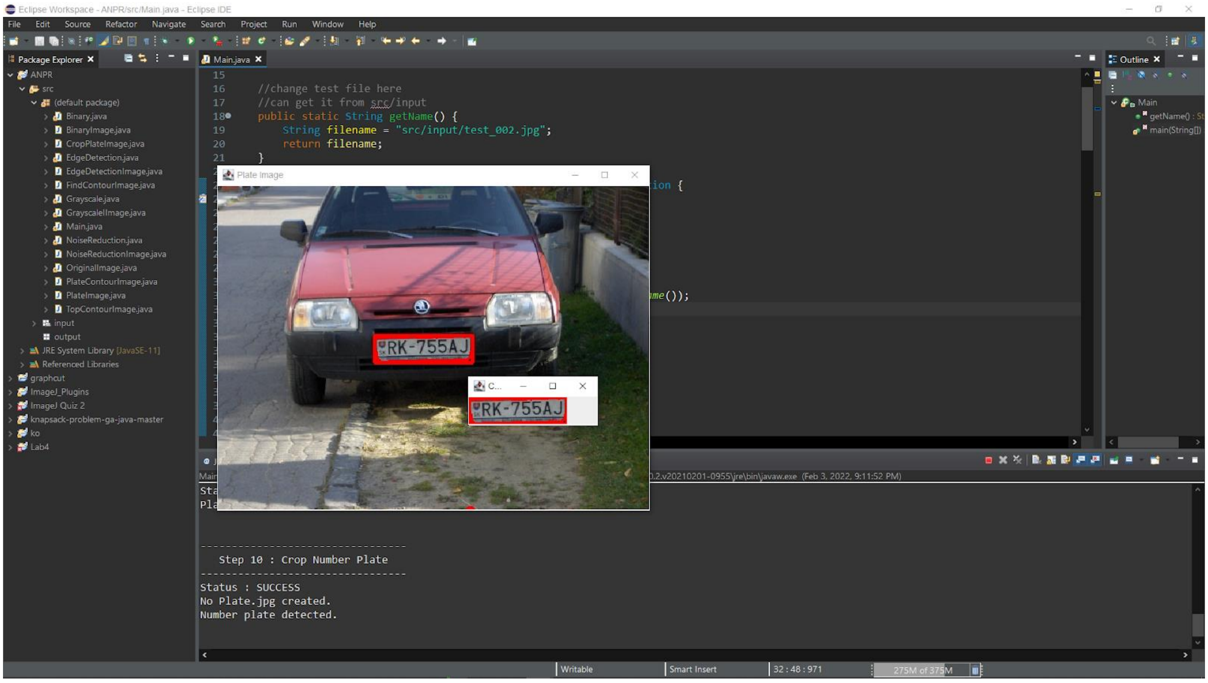

Figure 3.1: Example of success output.

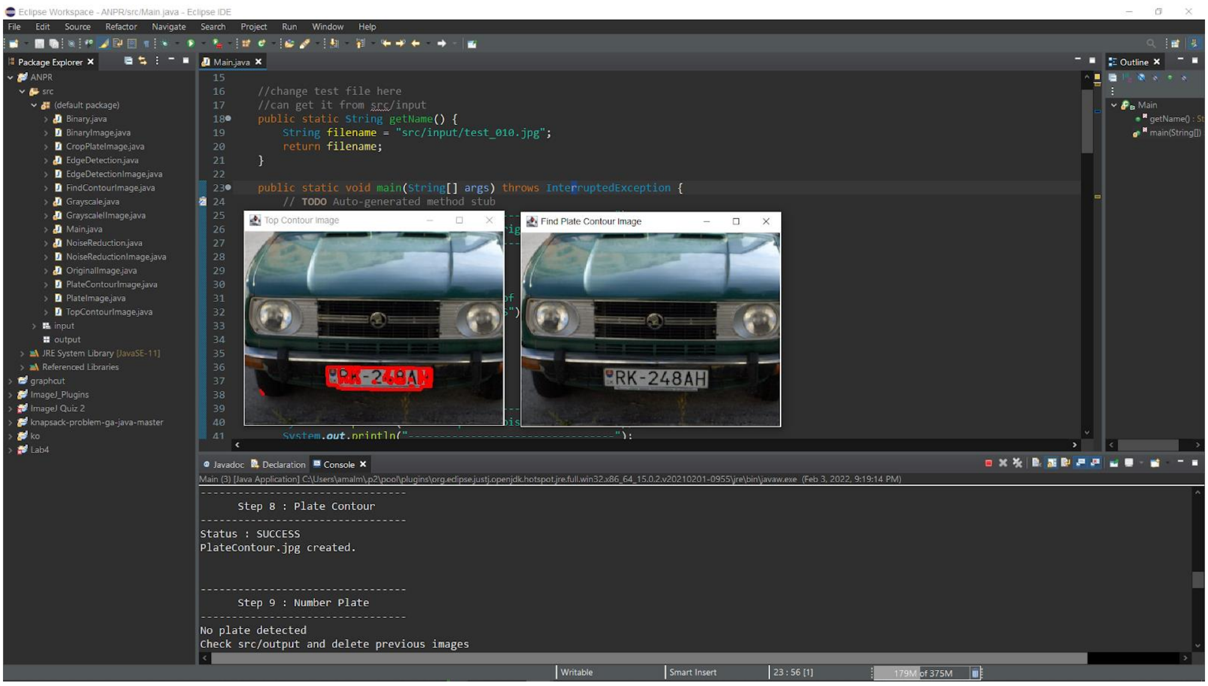

Figure 3.2: Example of failed output.

CONCLUSIONS

The proposed algorithms were tested on static images of vehicles from the dataset. The static image will be divided into several sets before being tested in the program. Sets of some images give worse recognition rates than a set of images that have been captured clearly. The objective of the tests was not to find a perfect recognizable set of images, but to test the invariance of the algorithms on several random images systematically classified to the sets according to their properties. The techniques used in this project are edge detection, conversion of image to grayscale and lastly localize the region of interest.
The simulation above shows that the proposed algorithms works decently in recognizing number plate although there are some failures. The implementation still has room for improvement.

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