

An improved of Malaysian license plates detection using deep convolutional neural networks

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ABSTRACT – Nowadays, smart transportation system on vehicle plate detection becomes popular among researchers. In this work, focuses on license plate detection on the scene images. Motivated by the excellent result in different vision applications, Convolutional neural network (CNN) used to enhance the detection of the license plate. Initially, about 37-classes of character/non-character was trained using Convolutional Neural Network (CNN) in order to ensure the robustness of plate detection. Afterward, second plate or non-plate CNN architecture dispenses with the false positives. Based on the experimental result, the accuracy achieved for detection is 97.58 %.

1. INTRODUCTION

Lately, the detection and recognition of a vehicle license plate have pulled in significant research fields. The applications of LPDR mostly in security traffic control and. A lot of research work been carried out regarding LPDR, however, most of their works only function properly in controlled conditions.

The plate detection intends to limit the bounding boxes of license plate and recognition to distinguish characters inside the bounding boxes region. This work only focuses on license plate detection. Existing work on license plate detection typically depends on some high-quality images highlights that catch specific morphological or license plate textual type [1], [2]. These elements can be delicate to image conditions, but numerous false positives might found under complex features. The Convolutional Neural Networks (CNN) were used in this project since their great performance on different undertakings including classification of the image, object detection and semantic segmentation [3]. A framework using different proposed CNN classifiers for various reason. Regardless, a 4-layer 37-class consist of 10 digits, 26 capitalized letters, CNN classifier is utilized in a sliding-window. of whole images to detect the alphabet so that the saliency map of the text can be generated. The text-like regions separated based on the character's class. Afterward, 4-layer CNN of plate/non-plate classifier dismiss the false positives and detect license plates. As a result, this architecture able to make the plate prediction even though in the complicated background with high accuracy and efficiency.

2. METHODOLOGY

2.1 License Plate Detection

The detection of a license plate is the main phase of LPD, which affects the process of the entire framework. It is required to produce bounding boxes of the plate with high review and accuracy. The CNN and character-based plate detection utilizing a sliding window approach. Figure 1 shows the overall process of license plate detection.

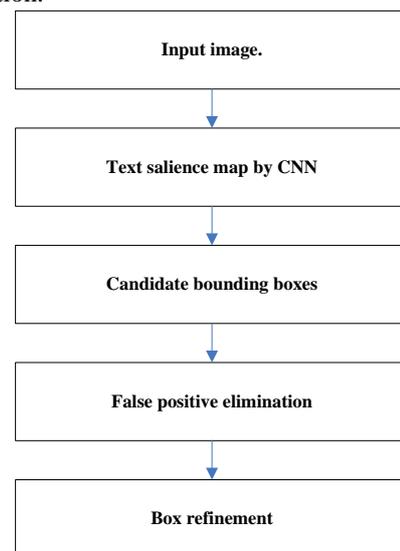


Figure 1 Plate detection overall process.

Since the main objective is to improve the processing speed of detection, a 4-layer CNN as shown in Figure 2 trained to locate the characters found in the image. Then the CNN were trained with 37-class which consist of 10 digitals, 26 capitalized letters and non-character class, a double content/non-character as dataset sample. Any letters or digitals found viewed as characters. Since a particular class learned, this can improve the result of detection. The training of CNN using grayscale characters of 24×24 pixels images, standardized by subtracting the mean of overall training information. The data expansion is using binary data to reduce overfitting. The CNN training utilizing Stochastic Gradient Drop (SGD) and back-propagation. The learning rate enhanced to guarantee the training process stable and faster.

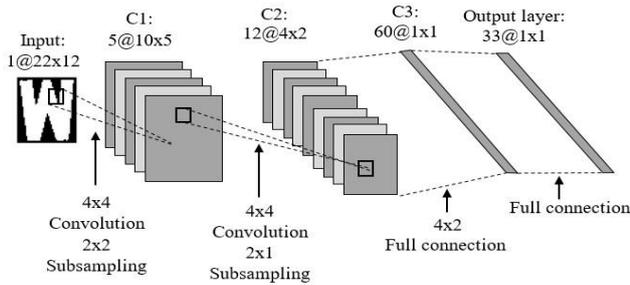


Figure 2 Four-layer CNN architecture.

2.2. False Positives Elimination

The created bounding boxes are filtered after all images prepared based on the geometric imperatives consist of aspect ratio, boxes height, and length. The procedure is shown in Figure 3. Lastly, plate/non-plate CNN utilized in order to verify the rest of the bounding boxes.

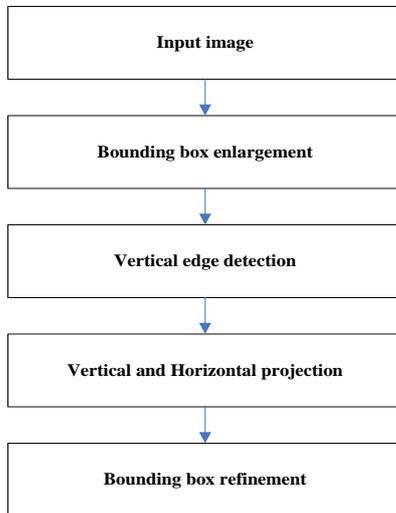


Figure 3 Bounding box refinement.

3. RESULT AND DISCUSSION

The training of CNN models for 37-way characterization utilize the previous training data. Figure 4 shows the generated bounding box for detection of a license plate and the objectives accomplished since the overall accuracy for the detection of license plate region reach about 97.58%.



Figure 4 The detected bounding box.

Table 1 shows the comparison of plate detection

between the previous works and the proposed method. Bai et al. and Le Li et al. using edge-based integrated the color information to reduce the false positive. Lim et al. using a character-based approach integrate with MSER method in detecting the characters. Proposed approach utilizes a 37-way CNN classifier, which able to learn character feature clearly.

Table 1 Comparison of plate detection based on precision and recall.

Author	Recall (%)	Accuracy (%)
Le at al.	61:60	71:40
Lim et al.	90:47	83:73
Bai et al.	68:70	74:10
Proposed method	94.73	97.58

Based on table above which shows that the proposed approach outperforms compared to all the strategies in both recall and accuracy. Using ICDAR dataset, it accomplishes about 94.73% of recall, which is 4.26% higher than accomplished by Lim et al. The accuracy of proposed approach is 97.58%, exceed approximately 13.85%.

4. CONCLUSION

As a conclusion, the developing of enhanced license plate detection utilizing CNN method completed. On the other hand, the best model of CNN detection algorithm completely built since the accuracy reach 97.58% for the detection of region area for Malaysian standard license plate characters. This system is only a part of character of license plate recognition and further improvement for this system can be in next recognition part.

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