

**Alexis Quesada-Arencibia
José Carlos Rodríguez
Roberto Moreno-Díaz
Roberto Moreno-Díaz jr.
Gabriel de Blasio
Carmelo Rubén García (Eds.)**

EUROCAST 2019

Computer Aided Systems Theory

EXTENDED ABSTRACTS

**17th International Conference on Computer Aided Systems Theory
Las Palmas de Gran Canaria, Spain, February 2019**

**Seventeenth International Conference on
COMPUTER AIDED SYSTEMS THEORY**

EUROCAST 2019

Edited by

Alexis Quesada-Arencia
José Carlos Rodríguez-Rodríguez
Roberto Moreno-Díaz and
Roberto Moreno-Díaz jr.
Gabriel de Blasio
Carmelo Rubén García

License plate localization using CNN-based numerical coordinate regression

D. F. Llorca¹, H. Corrales¹, I. Parra¹, and M. A. Sotelo¹

Computer Engineering Department, University of Alcalá, Alcalá de Henares, Spain.
{david.fernandez1, hector.corrales, ignacio.parra, miguel.sotelo}@uah.es

Abstract. In this work, we tackle the problem of vehicle license plate localization in traffic images. Instead of modeling the appearance of the license plate, and inspired by recent advances in human pose estimation, we propose to use a CNN-based model trained to infer the numerical location of the four corners that define the limits of the license plate. Coordinate regression by means of differentiable spatial to numerical transform (DSNT) layer [1] is used as a trade-off between speed and accuracy. Preliminary results support the proposed methodology.

Keywords: License Plate Detection · CNNs · numerical coordinate regression.

1 Introduction

Car license plate (LP) detection analyses an image to provide potential LP bounding boxes. It is the first stage of most of the LP recognition systems and it can be also used to accurately estimate relative distance and speed [2]. Although a considerable number of works have been proposed [3], accurate LP localization in the wild from arbitrary viewpoints, with partial occlusions and multiple instances remains as a challenging problem. Most of the existing approaches are focused on learning the appearance of the LP using features such as edges, color and texture. Other works pose the problem as a character detection task. These approaches are prone to errors when extreme viewpoints or occlusions are present. We tackle the LP localization problem as a keypoint detection problem, modeling the appearance of the four external corners using a CNN-model adapted to perform coordinate regression by adding a differentiable spatial to numerical transform (DSNT) layer as proposed in [1] for human pose estimation.

2 System Description and Results

A ResNet50 [4] model pre-trained with Imagenet [5] dataset is used. A DSNT layer is attached instead of the last 2 layers which allows a fully differentiable and spatially generalizable coordinate regression architecture[1]. We manage the assumption that only one LP is relevant at each iteration (the closest one), so the number of keypoints is four, representing the upper-left, upper-right, lower-right

2 D. F. Llorca et al.

and lower-left corners of the LP. Although the DSNT layer does not contain trainable parameters, the whole architecture is fine-tuned using our own dataset composed of 379 images of different vehicles approaching a parking entry. The input images size is 640×480 pixels. The standard heatmap size before the DSNT layer is 20×15 pixels. The stride and dilation factors of last and second-to-last layers of the ResNet50 model are adapted to provide a heatmap of 80×60 pixels, which increases the localization accuracy. Preliminary results are depicted in Fig. 1. Localization accuracy is lower than 2 pixels on average. As future works, further results will be obtained using larger datasets.

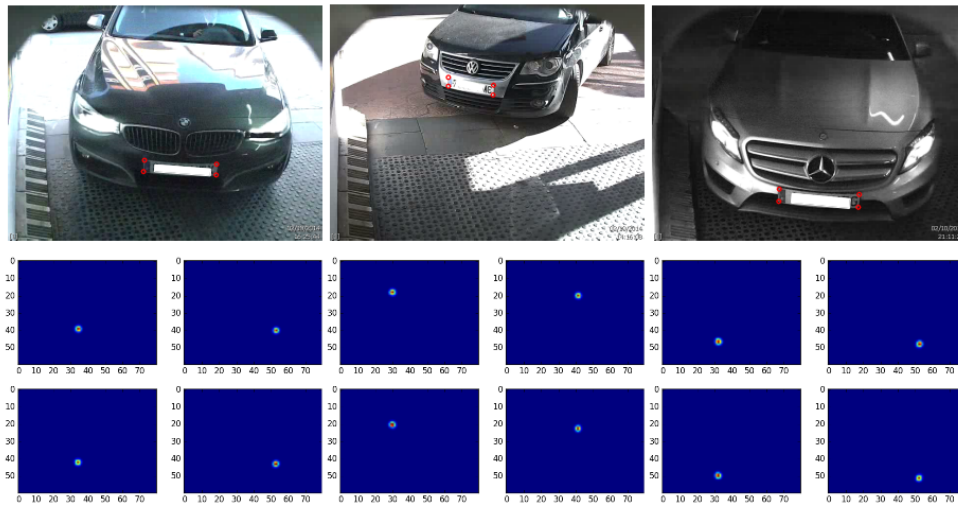


Fig. 1. Upper row: detected LP corners. Lower row: heatmaps for the four corners.

Acknowledgments

This work was supported by Research Grant EPIC DPI2017-90035-R.

References

1. Nibali, A., He, Z., Morgan, S., Prendergast, L.: Numerical Coordinate Regression with Convolutional Neural Networks. CoRR, vol. abs/1801.07372 (2018)
2. Llorca, D. F. et al.: Two-camera based accurate vehicle speed measurement using average speed at a fixed point. IEEE ITSC (2016).
3. Li, H., Shen, C.: Reading Car License Plates Using Deep Convolutional Neural Networks and LSTMs. CoRR, vol. abs/1601.05610 (2016)
4. He K., Zhang, X., Ren, S., Sun, J.: Deep Residual Learning for Image Recognition. CoRR, vol. abs/1512.03385 (2015)
5. Deng, J., Dong, W., Socher, R., Li, L.-J., Li, K., Fei-Fei, L.: ImageNet: A Large-Scale Hierarchical Image Database. CVPR09 (2009)