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Vehicle type detection based on deep learning in traffic scene

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Abstract

Nowadays, vehicle type detection plays an important role in the traffic scene. Deep Learning algorithm has been widely used in the field of object detection. Applied the Faster RCNN framework, improved the RPN networks, which was an effective and representative of the Convolutional Neural Network of deep learning on object classification algorithm, and combined with the MIT and Caltech car dataset as well as some different types of vehicle pictures in the Internet, to detection and recognization the three types of vehicles which are commom in traffic scene. The experimental results show the effectiveness and high-efficiency of method of deep learning in the vehicle type detection.

Keywords: Deep learning, CNN, Faster RCNN, RPN, vehicle type detection;

1. Introduction

In recent years, with the rapid growth in the number of transportation vehicles, traffic regulation faces enormous challenges. Vehicle type testing is an important part of intelligent transportation systems. Its function is to detect the type of vehicle and provide information for road monitoring and traffic planning. Vehicle type detection, as a key technology to construct video surveillance of traffic conditions, has long been widely concerned by researchers at home and abroad. Target detection is an important branch of image processing and computer vision. Its research methods are mainly divided into background-based modeling and method based on apparent feature information [1]. This paper mainly focuses on the detection algorithm based on vehicle target apparent feature information, that is, detects and classifies the vehicle target in the actual traffic video or picture. Its main difficulty lies in the picture or video frame of the vehicle target will change due to lighting, angle of view and the interior of the vehicle and other

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changes as well as the characteristics of different types of vehicles. In view of the above difficulties, scholars at home and abroad have made many attempts using traditional machine learning methods, but the results are not satisfactory.

The traditional method of target detection is generally divided into three phases: First, select a few candidate regions on a given image, and then extract features from these regions and classify them by trained classifiers. Here we introduce each of these three stages separately.

Area selection is to locate the location of the target. As the target may appear anywhere in the image, and the size of the target, the aspect ratio is not sure, so the first sliding window strategy to traverse the entire image, and you need to set a different scale, different aspect ratio.

For feature extraction, it is not so easy to design a robust feature due to the morphological diversity of the target, the diversity of light variations, and the diversity of the background. However, the quality of extracted features has a direct impact on the accuracy of classification. (HOG [1], SIFT [2], etc. are commonly used in this stage)

The final classifier mainly uses SVM[3], Adaboost [4]and so on.

To summarize, there are two main problems in traditional target detection: one is that the region selection strategy based on sliding window is not specific, the time complexity is high, and the window is redundant; secondly, the hand-designed features are not very good for the diversity change Robustness. For now, target detection based on traditional machine learning methods has encountered bottlenecks and a more scientific approach is expected.

With the rapid development of deep learning theory and practice, the goal of machine learning based detection and classification has entered a new phase. Unlike traditional feature extraction algorithms that rely on prior knowledge, deep convolutional neural networks have some degree of invariance to geometric transformations, deformations and illumination and effectively overcome the variability of vehicle appearance and are adaptive to training data Build feature descriptions for greater flexibility and generalization. For target detection, the recognition accuracy is an indicator that researchers want to improve all the time. Speaking of recognition accuracy, we must mention the mean average pre-measurement (mAP), which measures the detection accuracy in target detection. To put it simply, in the detection of multiple categories, each category can draw a curve according to recall and precision, then AP is the area under the curve, and mAP is the average of multiple categories of AP, which is between 0 To 1, and the bigger the better.

The paper [5] mainly uses DNN to do Deep Neural Networks. The author regards target detection as a regression problem, returns to the position of the Bounding Box, finds the position of the target category and the target in a picture, it reaches 30% mAP on the VOC 2007 test set. The paper [6] improved Alex-net and tested the network on the test dataset using image scaling and sliding window methods. A method of image localization was proposed. Finally, a convolutional network was used to classify, locate and detect three the computer vision task, with 24.3% mAP in the ILSVRC2013 test suite.

In 2014, RBG (Ross B. Girshick) designed the R-CNN framework [7] by using region proposal and CNN instead of sliding window add manual design features used in traditional target detection, making a great breakthrough in target detection and opening up a new algorithm based on depth Learning target detection boom. It combines traditional machine learning with deep learning to propose classical algorithms such as Selective Search [8], which increases the mAP of the VOC 2007 test suite to 66%. Followed by the optimization of target detection networks like SPP-net [9], Fast RCNN [10], Faster RCNN[11], YOLO [12] and SSD [13], but Faster RCNN puts all the target detection implementation modules To a unified deep convolutional network framework, the detection accuracy compared to other deep learning objectives detection methods are higher. To this end, this paper uses a Faster R-CNN target detection algorithm in depth learning domain and combines with vehicle images of different types of vehicles on MIT [14] and Caltech [15] vehicle databases and networks to construct a vehicle type detection system. Experimental results show that the system identifies more accurately the main types of vehicles in three types of traffic scenarios: cars, minibus and SUVs.

In addition to this, complex periodic arrays of dipolarly coupled magnetic dots are of special interest because they can support the propagation of non-reciprocal spin waves, i.e. ($w(k) \neq w(-k)$), where w is the angular frequency and k is a wave vector, which could find application in the signal transmission and information processing as well as in the design of microwave isolators and circulators..