Chapter 24
Nighttime Object Detection: A Night-Patrolling Mechanism Using Deep Learning

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ABSTRACT

These days, it's becoming harder to feel safer when we go out at night. So, to tackle this security problem, the authors propose a night patrolling mechanism to detect objects in low light conditions. Images taken during the nighttime have difficulties with less contrast, brightness, and noise owing to inadequate light or insufficient exposure. Deep learning-based methods accomplish end-to-end, unsupervised object recognition using convolutional neural networks, which abolishes the requirement to describe and draw out attributes separately. Despite the fact that deep learning has led to the invention of many successful object detection algorithms; many state-of-the-art object detectors, like Faster-RCNN and others, can't carry out at their best under low-light situations. Even with an extra light source, it is hard to detect the features of an item due to the uneven division of brightness. This chapter proposes a deep learning algorithm called single shot detector, with Mobilenet v2 as the backbone to tackle the issues of object detection under low-light situations.

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1. INTRODUCTION

Object detection is the primary job in many computer vision applications because it allows more information about the identified object and the scene to be obtained. Object detection has been used in a broad range of applications, including human-computer interaction, robotics service robots, electronic goods like smartphones, security like recognition, tracking, and retrieval such as photo management, search engines, and transportation. Object localization involves locating and sizing a single object that is known to be present in the image; object presence classification involves determining whether at least one object of a given class is present in the image (without providing any information about other elements) and object recognition involves determining whether a specific object is present in the image. The fourth associated issue, view and posture estimation, requires evaluation of both the view and the location of the object. There are different types of object detection algorithms.

1.1. Coarse-to-Fine and Boosted Classifiers

Viola and Jones' enhanced cascade classifier is the most popular study in this area (2004). It operates by effectively rejecting picture patches that do not belong to the object using a series of tests and filters. The employment of cascade techniques with boosted classifiers is common for two motives: I Because boosting produces an additive classifier, it is simple to manage the complexity of each level of the cascade; (ii) boosting may also be used for feature selection during training, allowing the usage of huge (parametrized) families of data.

1.2. Dictionary Based

The Bag of Word approach (Serre et al. (2005) and Mutch & Lowe (2008)) is the greatest example in this area. This method is primarily meant to detect a single item per picture, but it can also detect the remaining objects after eliminating an identified object (Lampert et al. (2009)). This technique has two flaws: it cannot reliably handle the circumstance of two instances of the item appearing near one another, and the object's localization may be inaccurate.

1.3. Deep Learning

Convolutional neural networks are one of the first effective approaches in this class. This strategy differs from the others in that the feature representation is learned rather than defined by the user, but it comes with the disadvantage of requiring a large number of training examples to train the classifier. Deep learning is the cause of all recent developments in artificial intelligence. Self-driving cars, chatbots, Alexa and Siri would not exist without deep learning. Neural networks are the root of all these technologies.

Traditional machine learning models like SVM and Naive Bayes classifiers stop progressing beyond a saturation point, however, deep learning models tend to get more accurate with more training data.