A lightweight automatic detection model for farmland pests

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Abstract

Crops cause serious losses due to pests every year, and automatic monitoring of pests has become an urgent problem to be solved. This paper proposes a lightweight pest detection model based on the idea of the YOLO-v3 object detection algorithm. First, a lightweight backbone is constructed to extract features through depthwise separable convolution, and then PANet is used to achieve multi-scale feature fusion. Finally, three feature matrices with different sizes are output to predict pests of different sizes. The results show that in the dataset of 26 pests, the accuracy rate can reach 88.16%, which can accurately predict the status of farmland pests.

Ⅰ. Introduction

As the primary industry of social development, agriculture is an important industrial sector in the national economy. Although level of agricultural science and technology has been developed to an unprecedented level, the monitoring of pests has been troubling the workers. Traditional pest detection methods mainly rely on researchers to observe the body shape characteristics of pests and identify them according to the existing pest pictures. Artificial visual diagnosis is time-consuming and laborious, which is not conducive to the automation and systematization of pest detection[1].

With the rapid growth of computing resources, deep learning technology has achieved rapid development, which provides a technical basis for automatic pest detection. In this context, using advanced image processing technology, automatic pest identification and detection can be realized. In recent studies, the image processing model based on a convolutional neural network has achieved remarkable success. Therefore, this paper will realize the automatic identification and detection of farmland pests based on the method and theory of convolutional neural network and complete the monitoring of pests[2]-[3].

Ⅱ. Method

To realize the automatic detection and localization of farmland pests, a lightweight object detection network based on an anchor is proposed. The model architecture draws on the idea of YOLO(You only look once)[4]. The lightweight model structure is shown in Figure 1.

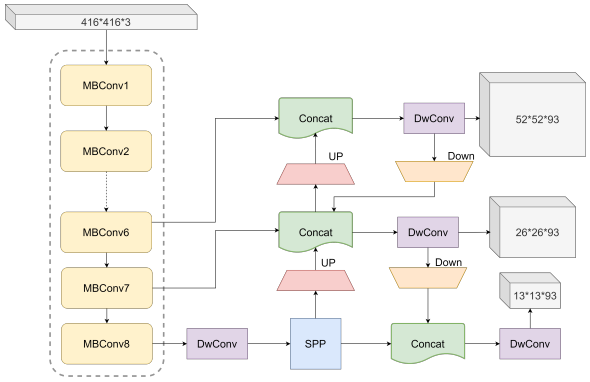

Fig 1. Model structure

The model consists of three parts: the first part, Backbone, is constructed based on the EfficientNet classification network and consists of 8 MBConv blocks in total[5]. The depth separable convolution is used instead of ordinary convolution to achieve a more lightweight model and complete feature extraction. The second part is Neck, which uses the PANet structure to fuse feature

matrices of different sizes to realize the fusion of low-level semantic information and high-level semantic information and complete feature fusion. In the third part of Head, in Neck, after completing the stacking of feature fusion, the output size is (13,13,93), (26,26,93), and (52,52,93) feature matrix for predicting pests of different sizes.

Ⅲ. Conclusion

Pest detection is an important means to predict agricultural pest disasters. Aiming at the fact that the existing target detection model requires huge computing resources for calculation, a lightweight pest detection model is proposed, which realizes the operation in the device with low computing power. The model is primarily designed to monitor pests in farmland, enabling scale and automation of pest monitoring. In practice, it is shown that the algorithm can effectively solve the problems of many pests, pest accumulation, background interference, etc., and has strong robustness.

References

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