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Lightweight improved yolov5 model for cucumber leaf disease and pest detection based on deep learning

Signal, Image and Video Processing

Aims and scope

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Abstract

Many diseases and pests affect cucumber leaves as they grow. A lack of prompt control may result in reduced yields or crop failure. Early and correct detection of cucumber leaf diseases and pests is essential to prevent cucumber yield reduction. Manual detection consumes a large amount of human resources and exhibits poor real-time performance. In addition, there is a lack of public datasets for cucumber leaf disease images in real-world scenarios. To this end, firstly, this study collected and established a new cucumber leaf pest and disease dataset in a real-world scenario. Secondly, to accurately detect cucumber leaf diseases and

pests, an improved cucumber leaf disease and pest detection model was proposed from scratch based on the original YOLOv5l model. To reduce the model size, the Bottleneck CSP module was used instead of C3 as the backbone and neck network section. Owing to the reduction in the number of parameters, number of layers, and calculations, the detection impact was significantly improved, in addition to that, the improved model able to detect even a small leaf spot of disease. Finally, the authenticity of the proposed model is demonstrated by incorporating the convolutional block attention module (CBAM) into both the improved and original YOLOv5l model. The experimental results showed that the mean average precision (mAP) of the improved model was 80.10%; whereas, the precision and recall were 73.8%, 73.9%, respectively. The improved model weight occupies only 13.6 MB of the memory. The overall improved model performance outperformed that of the original YOLOv5 model.

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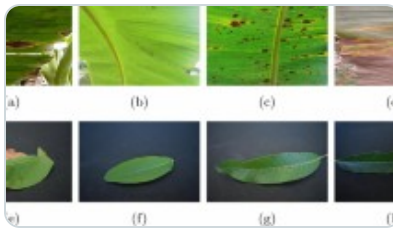Institutional subscriptions →

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Data availability

The dataset generated during the current study are available from the corresponding author on reasonable request.

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Conceptualization contributed by SO, KG and SA; methodology contributed by SO; data curation contributed by SO; writing—original draft preparation contributed by SO, KG and SA; writing—review and editing contributed by SO, KG. and SA; supervision contributed by KG. and SA.; All authors have read and agreed to the published version of the manuscript.

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Ethics declarations

Conflict of interest

The authors declare that they have no conflict of interest.

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