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PLANT DISEASES AND PETS DETECTION BY DEEP LEARNING DIGITAL IMAGE PROCESSING

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Abstract- Plant diseases and pests is one kind of natural disasters that affect the normal growth of plants and even cause plant death during the whole growth process of plants from seed development to seedling and to seedling growth. In machine vision tasks, plant diseases and pests tend to be the concepts of human experience rather than a purely mathematical definition.

Plant diseases and pests detection is a very important research content in the field of machine vision. It is a technology that uses machine vision equipment to acquire images to judge whether there are diseases and pests in the collected plant images. At present, machine vision-based plant diseases and pests detection equipment has been initially applied in agriculture and has replaced the traditional naked eye identification to some extent.

Compared with the definite classification, detection and segmentation tasks in computer vision, the requirements of plant diseases and pests detection is very general. In fact, its requirements can be divided into three different levels: what, where and how. In the first stage, "what" corresponds to the classification task in computer vision.
Image recognition is the task of identifying images and categorizing them in one of several predefined distinct classes. So, image recognition software and apps can define what's depicted in a picture and distinguish one object from another.

The methods used in the discovery of pesticide chemicals also have largely been empirical. With little or no prior information on mode of action, chemicals are tested to select those that kill the target insect, fungus, or weed but do not harm the crop plant or the environment.

Introduction

The scientific review finds that climate change will increase the risk of pests spreading in agricultural and forestry ecosystems, especially in cooler Arctic, boreal, temperate and subtropical regions. For example, a single, unusually warm winter may be enough to assist the establishment of invasive pests.

Some pests, like fall armyworm (which feeds on a growing number of crops, including maize, sorghum, millet) and Tephritid fruit flies (which damage fruit and other crops), have already spread due to warmer climate. Others, such as the desert locust (the world's most destructive migratory pest), are expected to change their migratory routes and geographical distribution because of climate change.

Climate change-induced pest dispersal and intensity threaten food security as a whole. Small holders, people whose livelihoods rely on plant health and

those who live in countries beset by food insecurity are especially vulnerable to these risks.

The damage to plants caused by competition from weeds and by other pests including viruses, bacteria, fungi, and insects greatly impairs their productivity and in some instances can totally destroy a crop. Today, dependable crop yields are obtained by using disease-resistant varieties, biological control practices, and by applying pesticides to control plant diseases, insects, weeds, and other pests. In 1983, $1.3 billion was spent on pesticides—excluding herbicides—to protect and limit the damage to crops from plant diseases, nematodes, and insects.

Vision mission

Integrated crop protection involves combining various sustainable crop protection methods in order to avoid diseases and pests or to suppress them. The aim is to harm the environment as little as possible. Chemical agents are used only to a very limited extent.

The EU stimulates the use of integrated crop protection methods in order to make the agricultural and horticultural sectors less dependent on pesticide, Crop control should involve the following three steps in succession:

1. Planning cultivation methods and choosing plants should involve preventive measures such as using disease-free seed, selecting resilient varieties and deploying resilient systems.

2. During the growth period, the crop should be monitored carefully using, for example, Simulation Models and Decision Support Systems.

3. If a disease or pest does threaten to affect a crop, the control method should be selected with care. If the only option is a pesticide, a biological one is preferred – together with mechanical and other non-chemical methods.

4. Our research on plant viruses specifically focuses on the role and impact of plant viruses in various agricultural systems as well as ecosystems. This involves their identification, trying to understand why they cause diseases and studying how they spread, including their vectors like insects and fungi.

5. The continuous development of economy and society has brought about global climate and environmental problems. The occurrence of diseases and insect pests seriously affects people's life. The incidence and occurrence of plant diseases and insect pests is higher and higher and more complex (Food and Agriculture Organization of the United Nations,). Therefore, it is very important to study the prevention of plant diseases and insect pests, as well as the diagnosis and remedial measures of plant diseases and insect pests. Plant disease management faces ever-growing challenges due to: (i) increasing demands for total, safe and diverse foods to support the booming global population and its improving living standards; (ii) reducing production potential in agriculture due to competition for land in fertile areas and exhaustion of marginal arable lands; (iii) deteriorating ecology of agro-ecosystems and depletion of natural resources; and (iv) increased risk of disease epidemics resulting from agricultural intensification and monocultures. Future plant disease management should aim to strengthen food security for a stable society while simultaneously safeguarding the health of associated ecosystems and reducing dependency on natural resources.

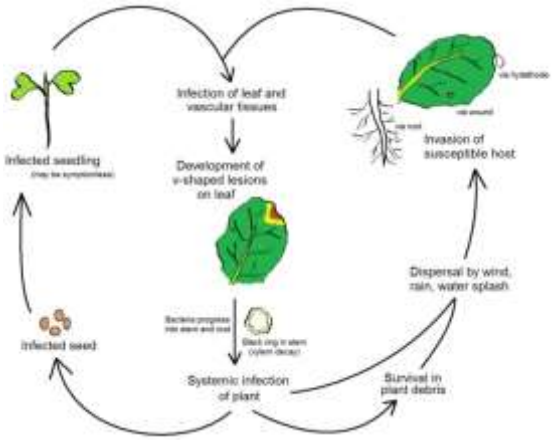
Discussion

Plant diseases and pests are important factors determining the yield and quality of plants. Plant diseases and pests identification can be carried out by means of digital image processing. In recent years, deep learning has made breakthroughs in the field of digital image processing, far superior to traditional methods. How to use deep learning technology to study plant diseases and pests identification has become a research issue of great concern to researchers. This review provides a definition of plant diseases and pests detection problem, puts forward a comparison with traditional plant diseases and pests detection methods. According to the difference of network structure, this study outlines the research on plant diseases and pests detection based on deep learning in recent years from three aspects of classification network, detection network and segmentation network, and the advantages and disadvantages of each method are summarized. Common datasets are introduced, and the performance of existing studies is compared. On this basis, this study discusses possible challenges in practical applications of plant

diseases and pests detection based on deep learning. In addition, possible solutions and research ideas are proposed for the challenges, and several suggestions are given. Finally, this study gives the analysis and prospect of the future trend of plant diseases and pests detection based on deep learning.

Plant diseases and pests detection is a very important research content in the field of machine vision. It is a technology that uses machine vision equipment to acquire images to judge whether there are diseases and pests in the collected plant images. At present, machine vision-based plant diseases and pests detection equipment has been initially applied in agriculture and has replaced the traditional naked eye identification to some extent.

1. In different growth cycles, the appearances of diseases and pests are different. Therefore, the images of diseases and pests should be divided more carefully, and the same class of diseases and pests should be divided according to the growth period as the standard. In the future, the division of dataset will be improved.



2. In order to make the model more widely applied, the next work will collect a large number of high-quality images of different types of diseases and pests, and proceed to insert other insect pests, optimize and adjust the model, and extend this to other crops, so as to improve the practicability and accuracy of crop diseases and pests image recognition.

Future Directions

For traditional machine vision-based plant diseases and pests detection method, conventional image processing algorithms or manual design of features plus classifiers are often used. This kind of method usually makes use of the different properties of plant diseases and pests to design the imaging scheme and chooses appropriate light source and shooting angle, which is helpful to obtain images with uniform illumination. Although carefully constructed imaging schemes can greatly reduce the difficulty of classical algorithm design, but also increase the application cost. At the same time, under natural environment, it is often unrealistic to expect the classical algorithms designed to completely eliminate the impact of scene changes on the recognition results. In real complex natural environment, plant diseases and pests detection is faced with many challenges, such as small difference between the lesion area and the background, low contrast, large variations in the scale of the lesion area and various types, and a lot of noise in the lesion image. Also, there are a lot of disturbances when collecting plant diseases and pests images under natural light conditions.

Traditional plant diseases and pests detection algorithms mainly adopt the image recognition method of manual designed features, which is difficult and depends on experience and luck, and cannot automatically learn and extract features from the original image. On the contrary, deep learning can automatically learn features from large data without manual manipulation. The model is composed of multiple layers, which has good autonomous learning ability and feature expression ability, and can automatically extract image features for image classification and recognition. Therefore, deep learning can play a great role in the field of plant diseases and pests image recognition. At

present, deep learning methods have developed many well-known deep neural network models.

Image recognition (or image classification) is the task of identifying images and categorizing them in one of several predefined distinct classes. So, image recognition software and apps can define what's depicted in a picture and distinguish one object from another.

The field of study aimed at enabling machines with this ability is called **computer vision**. Being one of the computer vision (CV) tasks, image classification serves as the foundation for solving different CV problems, including:

Image classification with localization – placing an image in a given class and drawing a bounding box around an object to show where it's located in an image.

1. Planning cultivation methods and choosing plants should involve preventive measures such as using disease-free seed, selecting resilient varieties and deploying resilient systems.

2. During the growth period, the crop should be monitored carefully using, for example, Simulation Models and Decision Support Systems;

3. If a disease or pest does threaten to affect a crop, the control method should be selected with care. If the only option is a pesticide, a biological one is preferred – together with mechanical and other non-chemical methods. Chemical means should be used only as a last resort.

Conclusion

In different growth cycles, the appearances of diseases and pests are different. Therefore, the images of diseases and pests should be divided more carefully, and the same class of diseases and pests should be divided according to the growth period as the standard. In the future, the division of dataset will be improved. In order to make the model more widely applied, the next work will collect a large number of high-quality images of different types of diseases and pests, and proceed to insert other insect pests, optimize and adjust the model, and extend this to other crops, so as to improve the practicability and accuracy of crop diseases and pests image recognition.

Based on our current, limited understanding of the types of interactions that occur between host plants and pathogens, the mechanisms involved are varied and complex. Theoretically, a minimum of two criteria are involved. The first is recognition. There may be preformed molecules in both host and parasite that can interact. Second, there must be metabolic changes in the host or pathogen or both that are triggered by the initial interaction step. Genetic mutations in either host or pathogen can change the specificity of molecular interactions or their ability to trigger metabolic change.

Reference

[1].https://plantmethods.biomedcentral.com/articles/10.1186/s13007-021-00722-9.

[2].https://www.altexsoft.com/blog/image-recognition-neural-networks-use-cases/.

[3].https://www.fao.org/news/story/en/item/1402920/icode/.

[4].https://www.ncbi.nlm.nih.gov/books/NBK216440/#:~:text=The%20damage%20to%20plants%20caused,can%20totally%20destroy%20a%20crop.

[5].https://www.wur.nl/en/Research-Results/Research-Institutes/plant-research/Biointeractions-Plant-Health/Diseases-and-pests-in-crops.htm.

[6].https://www.frontiersin.org/articles/10.3389/fpls.2020.00898/full.