Discussion on Agricultural Insect Image Recognition and Pest Warning Based on Deep Learning

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Abstract: The food security issue is not only closely related to the national economy and people's livelihood, but also has a direct impact on social stability. To ensure food security, it is necessary to monitor and warn the pests in real time. The article first introduces the concept and characteristics of deep learning, and then proposes a design scheme of insect image recognition system based on deep learning. Finally, based on the actual situation, the discussion on the design and optimization of pest early warning system is carried out.

1. Introduction

As an indispensable part of computer vision, image recognition is improving with the advancement of technology. It is necessary to take image preprocessing as the premise, and the target recognition system designed according to the target feature can not satisfy the society. Demand, this paper takes deep learning as the foothold, and uses the convolutional neural network to identify and extract images, which plays an important role in improving the detection performance of image recognition models.

2. Depth Learning Overview

Deep learning refers to a learning model with multi-level hidden perceptron as the core. It can combine low-level features into high-level features through nonlinear transformation to explore data hiding relationships and determine distributed features. the goal of. Deep learning can use representation learning to learn the intrinsic connection of data, or use the model corresponding to multi-level perceptron to represent the Abstract.level data, and also extract the hidden relationship of data by means of back propagation calculation. Based on this, the neuron parameters are adjusted[1]. It can be seen from the above analysis that deep learning can retain the important information of the data to the greatest extent, and the work of selecting the features artificially will naturally reduce the workload.

It can be seen from the above description that deep learning needs to be studied from low to high. After receiving the data input by the lower layer, each layer of neurons extracts the data feature information according to specific rules. On this basis, it will be converted. The characteristic information is transmitted to the high-level neurons. Practice has proved that the method of extracting features layer by layer can ensure the extracted feature information, and it has the Abstraction and validity that it should be. Because of this, deep learning is applicable to most data such as biology and images, and the results are basically In line with expectations. The advantages of the existing deep learning framework are mainly reflected in the following aspects: one is modular, the user can directly call the packaged network components according to their own needs, complete the model construction work; the other is compatibility, the existing framework Gpu and cpu modes are generally supported and can be used on different devices.

3. Insect Image Recognition Based on Deep Learning

The deep learning network should meet the following requirements in order to fully exploit its advantages in insect image recognition. First, because the research topic in this paper is agricultural

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insects, the target of the task is relatively large. Therefore, the deep learning network should have the function of identifying large and medium-sized targets. Second, the insect data set used in this paper is small. The network is required to have good performance in feature learning and anti-over-fitting; thirdly, it is based on the research application value, and the premise of maintaining the model recognition rate, shortening the time required for the network to detect images, and Need to ensure good portability, can be used by multiple platforms.

3.1. Collecting data sets

Through investigation, it can be found that the large data set that has been published lacks the dataset mainly based on insect images. Since the composition of the dataset image should be dominated by common agricultural insects, the dataset used in this paper has the following characteristics: The data set contains dozens of agricultural insects, which guarantees the research value of insect identification tasks. Secondly, the image quality is relatively high, which reduces the difficulty of constructing data sets. Finally, the pictures taken in the field are mainly used to restore The real living environment of insects.

3.2. Building a data set

Before the data set is augmented, the work of dividing the test set and the training set is completed according to relevant standards. The function of the test set is to evaluate the model identification accuracy and generalization performance. The role of the training set is to provide training work based on the insect identification network. Support on the data. Training deep learning networks usually requires a large amount of data as a basis. If the training set is too small, it will not only reduce the accuracy of network recognition, but also lead to over-fitting of the network. It can be seen that expanding the training set data is to ensure network learning. The key to the effect is to avoid the situation where the model recognition effect is deviated due to the large difference in the number of insect images, and the relevant personnel should adjust the expanded data set to ensure that the number of insect images is basically the same[2].).In addition, training the insect image recognition network, it is also necessary to mark and save the target category and location, so as to ensure that the deep learning network can complete the training task according to the marked information, and the effect is often more in line with expectations.

3.3. Regional Suggestion Network

The regional suggestion network should be connected to the last layer of the convolutional layer. When designing it, the relevant personnel should design the network sliding window on the feature map, and only need to slide the window to complete the task of extracting the candidate window. The computational burden is reduced. The point at the center of the sliding window, also known as the anchor point, has the feature of being able to map to the original image. To make the suggestion window meet the different size requirements, the multi-scale method is used to increase the sliding window scale ratio. Is necessary.

3.4. Model Training

Based on the network model derived from deep learning, direct network training, pre-training and fine-tuning are combined. For experiments with small data sets, direct network training can achieve limited results. Therefore, the following focuses on pre-processing. The network mode combining training and fine-tuning is discussed. The model is characterized by using the post-training model to initialize the experimental network. It has been proved that the reasonable application of this model can not only improve the training accuracy, but also reduce the time required for training. The pre-training models applied in this experiment have been systematically and thoroughly trained. The pre-training model is trained based on the huge data set, and it is applied in the process of fine-tuning training, which can avoid the over-fitting of the network. The performance will also be improved. In addition, the benefits of this include shortening the model convergence time and improving the recognition accuracy.

In summary, the basis of insect identification research is to have high-quality data sets.

High-quality images can significantly improve the maturity of training based on models. It can be seen that the impact of data sets on insect identification is intuitive and far-reaching. The suitable model can provide important help for the efficient identification of insects. The content discussed in this paper mainly focuses on constructing data sets and selecting network models for reference by relevant personnel.

4. Pest Detection System Based on Deep Learning

The application range of deep learning is expanding with its development. Among them, the most representative application is the image recognition mentioned above, and the efficiency of monitoring and early warning of pests is also improved. In the following, deep learning is used as an entry point, and discussions are held around the pest warning system, hoping to help people.

4.1. System composition

The pest early warning system designed by deep learning is mainly composed of three parts: the sensing layer, the data layer and the application layer. The sensing layer should be applied to a new type of trap with a camera and a capture device. The function of the camera is to collect the image information in the trap in real time. The function of the capture device is to capture the pests on the surface of the grain; the role of the data layer is mainly Real-time monitoring of grain storage, intelligent detection of pests, and monitoring application services; with the help of mobile development technology, the application layer completes the task of providing grain storage location distribution, real-time display of pest warning information, overall density, and classification probability[3].The three parts rely on the network to interact with the data, the interaction between the sensing layer and the data layer, relying on WiFi or ZigBee, the interaction between the data layer and the application layer, relying on the 4G network, the three parts have a clear division of labor, through close cooperation, Form a pest warning system.

4.2. Building a model

Large-scale collection of common agricultural pest samples, such as rice elephants, red valleys, use cnn to achieve learning and training tasks, obtain specific data of sample feature points, and provide reference for the later identification, detection of pest image information and related work. The function of the convolutional layer is mainly to perform convolution operations, extracting different features of the input image information, and increasing the convolution depth, so that the cnn can have the function of iterating the complex features from the low-level feature points, so that the extraction is greatly improved. The idea of feature point capabilities becomes a reality.

4.3. Collecting and detecting pest information

Randomly deploy the pest trap on the surface of the grain, upload the captured image information to the self-built server, use the established model to complete the inspection, determine the species and probability of the pest, and rely on the web service to release the test to the mobile client. The results are for reference by relevant personnel.

4.4. Development of mobile terminals

The mobile terminal should use the gis form to display the distribution position of the grain storage to facilitate the monitoring and management of agricultural pests. Specifically, the content displayed by the mobile terminal should include early warning information, pictures captured in real time, and major pest risks. Research shows that the developed mobile terminal can fully play its role only if it meets the following requirements: Firstly, real-time access to the self-built server to acquire and display the captured image information of the capture device; secondly, return to the capture device The image and information are captured in real time; finally, the access system determines the approximate risk value based on the type of pest and the probability of the pest provided by the trap. Although the pest early warning system based on deep learning is still in the stage of exploration, compared with the traditional early warning system, there is a big

breakthrough in speed and precision, which requires relevant personnel to carry out the process in the actual application process. Targeted adjustment and optimization ensure that the value of deep learning is fully realized.

5. Conclusion

In summary, the early warning and prevention of agricultural pests has always been the main factor restricting agricultural development. Taking deep learning as the starting point, we design a system that can identify agricultural insect images. On this basis, we will complete the construction of the pest early warning system. The work, both in the agricultural field and in the biological field, has important significance and value. I hope that the content discussed above can be inspired by the people involved in the work.

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