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A Survey on Peach Disease Detection Using Machine Learning and Deep Learning Techniques

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ABSTRACT— To meet the food prerequisites of the seven billion individuals on Earth, different progressions in agribusiness and industry have been made. Diseases in fruit cause devastating problem in economic losses and production in agricultural industry worldwide. Peach is a type of fruit and its production is affected by peach diseases. In their process of peach growth it's often affected by various factors leads to the loss of its edible ability. Peach diseases can cause severe yield reduction and decreased quality for peach production. Deep learning techniques has been applied to detect peach diseases using image data. Common Peach diseases are Anthracnose, Bacterial Spot, Brown rot, Scab. Rapid, accurate detection and identification of peach diseases are great importance. In this survey investigate various techniques are used and models from image processing and deep learning methods to detect fruit disease. Finally paper presents an in-depth review of these studies and provide merits and demerits and future development of fruit disease detection, to provide a solution to peach disease detection.

Keywords—Image processing, Image Recognition, Deep Learning.

I. INTRODUCTION

Agriculture is the science and art of farming that includes cultivating the soil, growing crops, and raising livestock [1].Agriculture is a significant source of income for Indians. Occasionally, the disease of manual identification is a time-consuming and laborious process.

One of the critical difficulties confronted today is satisfying the always developing prerequisites and requests for quality food items. However various variables like harvest sicknesses, environmental change, and numerous others straight forwardly affect food creation, crop infection has been accounted for as one of the primary wellsprings of food misfortunes that contrarily impacts limited scope ranchers.

The peach is a deciduous tree native to North China, especially the Tarim Basin and also the north hillsides of the Kunlun Mountains that was first domesticated and cultivated. It produces edible, juicy fruits with a variety of attributes, the most common of which are peaches and nectarines.

Peach plants have a short lifespan when compared to other fruit trees. Orchards are replanted after 8 to 10 years in certain areas, whereas in others, trees can produce satisfactorily for 20 to 25 years or more, depending on disease, pest, and cold damage resistance. They are sensitive to extreme cold and cannot be successfully cultivated in temperatures below 23 to 26 °C (10 to 15 °F).

In commercial and personal orchards, peach fruit [2] diseases can result in severe productivity and quality losses. These infections are frequently undetected until late in the season or just before harvest. Although there are no cures for sick fruit, cultural practices and (optional) fungicides can help avoid many illnesses. However, accurate diagnosis is essential for determining the optimal management techniques and preventing future losses.

Anthracnose peach which has salmon color spores in circles 75^0 to 86^0 F young fruit, Bacterial spot which has tiny water-soaked spots that become pitted and cracked 70^0 to 85^0 F after shuck split Brown rot has soft rot covered with tan to grey colored fungal growth 68^0 to 82^0 F 2 to 3 weeks before harvest Scab has velvety olive-green spots that eventually crack; usually near stem end 77^0 to 86^0 F after shuck split.

As a result, we must identify the disease early on and provide a remedy to the farmer so that harm can be averted and productivity can be maximized. We developed the information to assist

agricultural sector in recognizing illness early on and providing them with necessary management measures. We need to build a system that will recognize peach disease by image processing, in which farmers can take photos of diseased leaves or fruits and the image will be processed through various processes to identify and recognize the disease.

Computer vision occupies an eminent position in identification of image processing, in order to get accurately fruit disease and damage the degree. The technique of image segmentation to increase the algorithm of morphological watershed, threshold segmentation and edge detection are utilized to realize the image in diseased parts and normal parts of the fruit segmentation. In which applied to various machine learning algorithms such as k nearest neighbour,Decision tree and Support Vector Machine and various machine learning algorithm has been used. There are some disadvantages while using machine learning, while extracting features accuracy of model will low.

Deep learning model which Convolution Neural Networks (CNN),PCNN Parallel Convolution Neural Network , Deep convolution neural network gives the better results for the image classification task compared to the other machine learning models.

The organization of this paper follows. Section II describes the literature survey of the fruit classification and detection process. Section III gives the comparative analysis of the existing methods. Finally, section IV concludes this survey and gives the proposed idea to implement in future.

II. LITERATURE SURVEY

In this section, the previous researches of the fruit classification and detection has been presented and analyzedwhich are done by earlier researchers.

Shuangjie Huang, et al.,[3]This study gives a denoising approach based on NLM for peach disease images, which makes the peach image feature performance easier to spot, in view of the changes of inaccurate detection and slow speed of classic CNN convolutional networks. After denoising, the data is processed using a parallel convolution neural network model, with the ipso optimized ELM replacing the softmax layer. The findings of the application reveal that the PCNN-IPELM technique is more effective in detecting peach defects. The technique first employs the ANLM image denoising algorithm to identify the characteristics of peach disease, then uses the parallel convolution neural network introduced in this paper to identify the characteristics of peach disease, and finally uses the parallel convolution neural network proposed in this paper, uses the improved elu activation function instead of the traditional Relu activation function, and finally uses the linear particle swarm optimized ELM (IPELM) proposed, In this paper in the last layer instead of the traditional soft ELM. The maximum detection accuracy for brown rot, black spot, anthracnose, scab, and normal peach was 95.02, 96.56, 97.37, 96.70, and 98.91 percent, respectively, based on 25513 pictures.

Wael Alosaim, et al., [5] Study proposed technology can also be used to pinpoint the disease's location and assist farmers in developing effective treatment to protect peach crops. In order to detect illnesses in Peaches, the VGG-19 architecture is used. Mask R-CNN is used to locate the position of disease regions. The proposed strategy has been tested using several methods and has shown to be 94% including on.

Rishi Agrawal et al., [6] The study proposes their dataset collection stage of this research entails data gathering and data labelling. Then, using the supplied dataset, we train a Convolutional Neural Network (CNN) model for automatic illness categorization of apples. CNNs are end-to-end learning algorithms that automatically extract features and learn complicated characteristics from raw images, making them appropriate for a wide range of applications such as image classification, object recognition, and segmentation. To initialize the parameters of the proposed deep model, transfer learning was used. To avoid overfitting, data augmentation techniques such as rotation, translation, reflection, and scaling were used. Performance measured by accuracy rate is 89.9%. The recall rate is 86.85%. Fmeasure has a score of 86.85 percent. Plant pathology apple dataset was used. For larger datasets, performance will be poor.

IM Nasir et al., [8] Study illiterates the deep learning as CNNs have been inspired by the human vision; they are intended to understand the underlying nature of an image. A CNN includes the corrected linear unit of convolutional grouping (Relu) and normalization layers, which often form fully connected layers, and an evaluated softmax grader the three-experiment classification methodology. The VGG19 activated the fully connected fc7 layer in the first experiment. Using 5G and cloud technology, a hybrid classification method combines a DCNN model with PHOG features to classify fruits. Second experiments, Classification results were obtained by extracting the characteristics of the prefabricated VGG19 DCNN model and the manually manufactured PHOG characteristics.. In the third experiment, we used a mass merge strategy, which was then enhanced by selecting the best features. The minimum number of (random) pictures per class in the DCNN models was set to 300. The performance

of our method was tested in terms of sensitivity, precision, area under the curve, format-and-restore (FNR) rate, and accuracy using ten-fold cross-validation and seven classification methods. 98percent accuracy (train) 90 percent accuracy (test).

HongJun Wang et al., [9] This paper utilizes apple, peach, orange, and pear as research objects and proposes a model based on Mask R-CNN for detecting disease spots on the surface of fruits which it accurately detects the deficiencies on the exterior of the fruit after the picking robot recognizes and locates the fruit to solve the current fruit exterior disease detection algorithm's problems of low accuracy, slow speed, and heavy workload of quality classification. The feature pyramid (FPN) structure of Mask R-CNN is improved by adding a bottom-up horizontal connection path, which improves the fusion of high and low-level features. The improved Mask R-CNN algorithm has a detection accuracy of more than 95% for the four types of fruit surface lesions, and the detection speed reaches 2.6 frames per second when using GPU, which is significantly faster than the Fast R-CNN and SSD algorithms and has good detection performance and robustness, according to experimental research.

Wenzhuo Zhang et al,[12] Proposed the Fuzzy C-means Algorithm and the Nonlinear Programming Genetic Algorithm (FCM-NPGA) were combined with a multivariate image analysis to suggest an apple flaw detection system. Using fractional differentiation, the image was first denoised and improved. The critical texture information was kept while the noise and edge points were removed. The image segmentation component has been treated by different methods due to the rapid development of computer vision. An algorithm for picture segmentation processing is also being improved. In recent years, the GA has attracted the attention of academics in both the United States and overseas. The FCM and NPGA algorithms were combined in this study to form the FCM-NPGA, which used the FCM algorithm's objective function as the GA fitness function. Simultaneously, the detailed information of the geometric feature image was kept in order to increase the local search ability. The FCM-NPGA was proposed and implemented based on nonlinear programming's high local search ability. The results of the experiments 98% accuracy for 2000 images.

Shivani et al., [10] The study discussed disease in apple fruit system uses the filter that is universal filter which used to enrich the precision of image along with the noise handling and also performs feature extraction. After features are extracted discrete color channel is enrich, in order to perform the segmentation. Segmentation process is performed using the algorithm k means clustering which can optimize the result and classification is handled using simple network as convolution neural network. CNN mechanism takes the segmented image pixels as population and generates distinct results in terms of classification accuracy as 97%.

Vasumathi et al.,[11] The study focuses on diseases in guava fruit in order to detect the disease in guava fruit can undergoes with two image database are used one for the training and other for testing. In the training phase, for the input images preprocessing and segmentation process is given to image, Preprocessing such as contrast stretching, noise filtering, and histogram modification is performed, Feature extraction is a dimensional reduction technique that uses a precise feature vector to represent important sections of an image. When image sizes are extremely large, this approach helps a lot. Clustering can be performed with the K-means clustering and classification performed using SVM classifier, the images splits with their Low level- 15 images with 61% accuracy, High level 25 images and accuracy 84%, Normal with 30 images and accuracy as 89%.

M.T.Vasumathi et al., [4] The study relates the CNN LSTM approach, sort pomegranate fruits into two main categories: normal and diseased. This researcher employed a hybrid CNN LSTM algorithm for detecting four different diseases in pomegranate fruits and classify them into four classifications. The outcomes of the CNN LSTM are then upgraded with the dragonfly technique. Fruit attributes such as color, texture, and shape are gathered and fed into the CNN-LSTM hybrid. The classifier's dataset is presented in the form of an excel file that has already been pre-processed using the map reduce technique and dimensionality reduction using Principal Component Analysis and Discriminant Analysis. The CNN LSTM classifier discriminate between the four diseases and healthy fruit. The dragonfly algorithm is used to improve the categorization. The optimized weight and cost function has been further investigated to aid in the diagnosis of multi-class diseases. Experiments have revealed that using the CNN-LSTM technique, classification accuracy is 92%, and using dragonfly techniques improves classification accuracy to 97.1 %

Lele Wang et al., [7] This study focuses on to predict thick plums in orchards, this research proposed a lightweight model based on the improved You Only Look Once version 4 (YOLOv4). To address the imbalance in the number of plums of different maturity levels and insufficient data quantity, we first used a data augmentation strategy based on category balance. Second, when it came to picking backbone feature extraction networks, we

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ditched Center and Scale Prediction Darknet53 (CSPDarknet53) in favor of a lighter MobilenetV3. To achieve the goal of decreasing model parameters, we used depth wise separable convolution (DSC) instead of normal convolution at the feature fusion stage. This model achieved fine-grained detection by introducing a 152*152 feature layer to overcome the problem of insufficient feature extraction in dense objects. The data automatic balance technique developed in this study for detecting immature plum has an accuracy of 86.34 percent, which is 6.11 percentage points greater than before the imbalance. The mAP increased by 2.72 percentage points from 86 to 88.72 percent. Overall, the recognition gap between plums of different maturity levels is reduced, and the model's robustness is improved.

III. COMPARATIVE ANALYSIS

The Table 1 summarizes the previous work of fruit disease classification and detection by using various techniques. It also includes the advantages and pitfalls of the existing work.

TABLE I. COMPARATIVE ANALYSIS

RefNo	Year	Observations	
		Methods used	Findings
[3]	2020	Parallel Convolution Neural Network, ELM	Parallel CNN can be reducing time and also noise removal by nonlocal means is added advantage
[5]	2021	Mask R-CNN used and VGG-19 Architecture used for the disease localization identification.	Where the R-CNN is suitable for region based data identificatio n
[9]	2020	Mask RCNN method used for identifying the disease	SSD used give the better performance
[4]	2021	PCA used for discriminant analysis and CNN LSTM model is used	Improves the accuracy and performance of the classificatio n by dragon fly algorithm.

IV. CONCLUSION

In this paper, presented the literature review for the classification and detection of fruit disease in agriculture lands and farms by using various machine learning, deep learning classification algorithms. From this study, we observed that peach disease detection was achieved better results in parallel convolution neural network. And also after done parallel-CNN can further move with transfer learning approaches.In future work, we will propose these methods for peach classification and detection task after applying the segmentation.

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