RESEARCH ARTICLE OPEN ACCESS

Prediction of leaf disease using svm classifier in python

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ABSTRACT

Having diseases is quite natural in crops due to changing climatic and environmental conditions. Diseases affect the growth and produce of the crops and often difficult to control. To ensure good quality and high production, it is necessary to have accurate disease diagnosis and control actions to prevent them in time. Grape which is widely grown crop in india and it may be affected by different types of diseases on leaf, stem and fruit. Leaf diseases which are the early symptoms caused due to fungi, bacteria and virus. So, there is a need to have an automatic system that can be used to detect the type of diseases and to take appropriate actions. We have proposed an automatic system for detecting the diseases in the grape vines using image processing and machine learning technique. The system segments the leaf (region of interest) from the background image using grab cut segmentation method. From the segmented leaf part the diseased region is further segmented based on two different methods such as global thresholding and using semi-supervised technique. The features are extracted from the segmented diseased part and it has been classified as healthy, rot, esca,and leaf blight using different machine learning techniques such as support vector machine (svm), adaboost and random forest tree. Using svm we have obtained a better testing accuracy of 93%.

I. INTRODUCTION

Indian economy is highly dependent on agricultural productivity of the country. Grape is very commercial fruit of india. It can easily be grown in all tropical, sub-tropical and temperate climatic regions. India has got different types of climate and soil in different parts of the country. This makes grapevines a major vegetative propagated crop with high socioeconomic importance. The grape plant will cause poor yield and growth when affected by diseases. The diseases are due to the viral, bacteria and fungi infections which are caused by insects,rust and nematodes etc., these diseases are judged by the farmers through their experience or with the help of experts through naked eye observation which is not accurate and time consuming process. Early detection of disease is then very much needed in the agriculture and horticulture field to increase the yield of the crops. We have proposed a system that can detect and identify diseases in the leaves of the grape plants.

This approach aims at overcoming two main challenges: first, cnn models require a large amount of data for training. However, each grape leaf disease appears in different time period, and the time for collecting disease images is limited. Thus, there are not sufficient diseased grape leaf images for the model's training. Second, the task of fine-grained image classification for grape leaf diseases is challenging, and models that are trained *via* transfer learning have difficultly realizing satisfactory performance. Therefore, the design of the optimal cnn structure for recognition grape leaf diseases is a daunting task.

The innovation of the paper lies in the application of the improved cnn algorithm for grape leaf disease recognition and the main contributions and innovations of this paper are summarized as follows:

● a grape leaf disease data set is established and lays an essential foundation for the generalization of the model. First, to enhance the robustness of the model, images of diseased grape leaves with complex and uniform backgrounds are collected. In addition, to alleviate the overfitting phenomenon of the model, the original diseased grape leaf images are processed *via* data augmentation technology to generate enough training images. Moreover, the digital image processing technology is used to simulate the images of grape leaf diseases in various environments, thereby greatly improving the generalization performance of the model.

● an improved cnn model is proposed for diagnosing grape leaf diseases. By analyzing the features of grape leaf diseased images, a novel deep convolutional neural network model, namely, the dense inception convolutional neural network (dicnn), is proposed. Deep separable convolution is first used by dicnn to build the first two convolutional layers to reduce the number of parameters and prevent the overfitting problem of the model. Then, inception structure is used to enhance the extraction performance for multiscale disease spots. Finally, the dense connection strategy is applied to the four cascade inception structures for alleviating the vanishing-gradient problem, encouraging feature propagation and reuse.

According to the experimental results, the accuracy of the dicnn model reaches 97.22%, which is better than other classic models. In addition, after data augmentation, using a data set of 107,366 diseased images of grape leaves, the accuracy increases by 14.42%, thereby exhibiting stronger robustness and better recognition performance.

II. LITERATURE SURVEY

To reduce the damage of diseases, many researchers have made tremendous efforts to identify plant diseases. With the continuous development of machine learning algorithms, they have been widely utilized to identify plant pests and diseases.

In (hamuda et al., 2017), hamuda et al. Proposed an automatic crop detection algorithm. The algorithm was used to detect cauliflowers from video streams in natural light under different weather conditions, and the detection results were compared with ground-truth data that were obtained *via* manual annotation. This algorithm realized a sensitivity of 98.91% and a precision of 99.04%. In (akbarzadeh et al., 2018), akbarzadeh et al. Proposed an approach for classifying plants that was based on support vector machine. The data set was composed of spectral reflectance characteristics of corn and silver beets at 635, 685, and 785 nm, with a rate of 7.2 km/h. The experimental results demonstrated that the proposed algorithm effectively classified the plants with an accuracy of 97%. In (wang et al., 2019), zhang et al. Proposed a cucumber powdery mildew recognition approach that was based on visual spectra. Through the classification and recognition of spectral features, the 450- to 780-nm visible light band was selected as the research range. Then, the svm algorithm was utilized to build the classification model, and the radial basis kernel function was applied to optimize the model. The experiments results demonstrated that this model realized accuracies of 100% and 96.25% for cucumber healthy leaves and powdery mildew leaves, respectively, and the total accuracy was 98.13%. In (waghmare et al., 2016), waghmare et al. Proposed a technique for identification of grape disease through the leaf texture analysis and pattern recognition. The system took a single leaf of a plant as an input and segmentation was performed after background removal. The segmented leaf image was then analyzed through high pass filter to detect the diseased part of the leaf. Finally, the extracted texture pattern was fed to a multiclass svm. In (mohammadpoor et al., 2020), mohammadpoor et al. Proposed an intelligent technique for grape fanleaf virus detection. Based on fuzzy c-mean algorithm, the area of diseased parts of each leaf was highlighted, and then it was classified using svm. In addition, k-fold cross validation method with k = 3 and k = 5 was applied to increase the diagnostic reliability of the system. Experimental results showed that the average accuracy of the system was around 98.6%. However, machine learning algorithms require cumbersome image preprocessing and feature extraction (kulin et al., 2017; zhang et al., 2018). In contrast, cnn can automatically distinguish and extract the discriminative features for image identification.

In recent years, cnns have made major breakthroughs in computer vision. Therefore, using cnn to identify plant diseases has become a research hotspot in agricultural information technology. In (khan et al., 2018), khan et al. Isolated the regions of infection from the background and utilized vgg and alexnet to extract the features of infection regions. Experiments were conducted on a plant village and casc-ifw, and a classification accuracy of 98.60% was realized. The experimental results demonstrated that the proposed model outperformed the available approaches with high-precision and high-recognition accuracy. In (zhang et al., 2019), zhang et al. Proposed a cucumber disease identification algorithm that was based on alexnet, namely, gpdcnn. The approach fused the contextual information effectively by combining global pooling layers *via* dilated convolution, which could optimize the convergence and increase the recognition rate. The gpdcnn model was trained on six common cucumber leaf diseases and a recognition accuracy of 94.65% was realized.

In (liang et al., 2019), liang et al. Proposed a rice blast diagnosis system that was based on cnns. The model was trained on a data set of 5,808 diseased images, which included 2,906 positive samples, and realized satisfactory performances in terms of the recognition accuracy, auc, and roc. The experimental results demonstrated that the proposed model could extract more discriminative and effective high-level features than the traditional approaches of lbph and haar-wt. In (zhang et al., 2019), zhang et al. Trained a three-channel cnn model for the recognition of tomato and cucumber leaf diseases. The approach utilized the three channels of rgb separately to use the color information and realized the automatic extraction of diseased features through color information. On the data set of tomato and cucumber leaf diseases, the proposed model outperformed the traditional approaches in terms of the classification accuracy. In (wagh et al., 2019), wagh et al. Proposed an automatic identification system of grape diseases for the recognition of five diseases including powdery mildew, downy mildew, rust, bacterial spots, and anthracnose. Feature extraction and model training of the leaf images were performed using pre-defined alexnet architecture. And experimental results showed that the model was able to accurately classify grape diseases. In (ji et al., 2019), ji et al. Proposed a united convolutional neural networks architecture based on an integrated method. The proposed cnns architecture, namely, unitedmodel was designed to classify common grape leaf diseases. Unitedmodel was able to extract complementary discriminative features owing to the combination of multiple cnns. And the experimental results had shown that unitedmodel realized the best performance on various evaluation metrics and achieved an average test accuracy of 98.57%.

According to these studies, cnns have obtained satisfactory results in plant disease recognition. However, cnns is rarely used in the field of grape leaf disease identification. In addition, most application-oriented image identification algorithms are based on popular transfer learning techniques, and few improvements have been made to the algorithms. Hence, an image identification model that is based on cnns for grape leaf diseases is proposed in this paper.

System analysis

III. EXISTING SYSTEM

The system proposed a segmentation method which has used mean based strategy for computing threshold and textual features were extracted and classification was done by svm. The survey proposed by vijai et al. In , discuses about different disease classification techniques used for plant leaf disease and used genetic algorithm for image segmentation. An integrated approach of particle swarm optimization and svm for plant leaf disease detection and classification was proposed in. Disease detection system for pomegranate leaves was proposed in which used colour-based segmentation and features like color, morphology and texture for classifying the leaves

Disadvantages

Used for plant leaf disease and used genetic algorithm for image segmentation

IV. PROPOSED SYTEM

We have proposed an automated disease detection and classification system for grape leaves using traditional image processing and machine learning techniques. The proposed system first segments the roi from the back ground using grab cut algorithm and classify the segmented leaves as healthy, balck-rot, esca and leaf blight. Figure. 1 depicts different types of disease in grape leaves. These diseases are caused due to fungi infection on the leaves. Each disease have different characteristics where black rot appears to be circular in shape and has dark margins, esca appears as dark red stripes and leaf blight appears to be solid reddish-purple spots. The proposed system consists of five different process such as image preprocessing, image segmentation, feature extraction, disease detection and identification

Image preprocessing, image segmentation

Advantages

System consists of five different process such as image preprocessing, image segmentation, feature extraction, disease detection and identification

V. SYSTEM MODULES

Modules implenetaion

Data collection:collect sufficient data samples and legitimate software samples.

Feature extraction:for each image extract the features ubsing image processing and save in '.csv' extension

Train and test modelling: split the data into train and test data train will be used for trainging the model and test data to check the performace

Modelling: svm naviebayes, random forest,knn,ada boost, decision tree, ada boost with randomforest . Combine the training using machine learning algorithms and establish a classification model.

VI. CONCLUSION

In this paper, we propose an automatic leaf recognition system that identify diseases in grape leaves using machinelearning technique. The proposed system first segments the leaf part from the background using grab cut segmentation technique.from the segmented leaves diseased region are identified using two different methods. The first method uses globlalthresholding technique whereas the second method using semisupervised learning technique. From the identified diseased part texture and color features are extracted and trained using different classifiers and the results are compared. We have used svm, random forest and adaboost algorithms for classification. We have achieved a better result of 93.035% as testing accuracy by using globlalthresholding and svm.

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