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A Novel Technique to Detect Plant Disease

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Abstract

One of the important sectors of Indian Economy is Agriculture. Employment to almost 50% of the countries workforce is provided by Indian agriculture sector. India is known to be the world's largest producer of pulses, rice, wheat, spices and spice products. Therefore, in field of agriculture, detection of disease in plants plays an instrumental role. Plants are highly prone to diseases that affect the growth of the plant, which in turn affects the ecology of the farmer. In order to detect a plant disease at initial stage, use of automatic disease detection technique is advantageous. The symptoms of plant diseases are conspicuous in different parts of a plant such as leaves, stem, flowers, buds, etc. Manual detection of plantdisease using plant components is a tedious job.

Keywords:*CNN, Image Processing, Diseased and Healthy leaf, Random forest, Feature extraction, Training, Classification.*

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INTRODUCTION

Due to industrialization and globalization concepts, the field is facing hurdles. On top of that, the awareness and the necessity of the cultivation need to be instilled in the minds of the younger generation. In older days, the experienced people do identification manually but due to the so many environmental changes, the prediction is becoming tough [1-4]. Generally, we can observe the symptoms of disease on leafs, stems, flowers etc. so here we use leafs, roots and stems for identification of disease affected plants. Some diseases do not have any visible symptoms, or the effect becomes noticeable too late to act, and in those situations, a sophisticated analysis is obligatory.

However, most diseasesgenerate somekindofmanifestation in thevisible spectrum, so the naked eye examination of a trained professional is the prime technique adopted in practice for plant disease detection [5,6]. In order to achieve accurate plant disease diagnostics a plant pathologist should possess good observation skills so that one can identify characteristic symptoms.

An automated system designed to help identify plant diseases by the plant's appearance and visual symptoms could be of great help to amateurs in the gardening process and trained professionals as a verification system in disease diagnostics [7-10].

LITERATURE SURVEY

Plant Disease Detection Using Machine Learning Shima Ramesh, Mr.RamachandraHebbar, Mr. P VVinod (November 2018 International Conference Paper)Crop diseases are a noteworthy risk to sustenance security, however their quick distinguishing proof stays troublesome in numerous parts of the world because of the non- attendance of the important foundation. Emergence of accurate techniques in the field of leaf-based image classification has shown impressive results. This paper makes use of Random Forest in identifying betweenhealthyand diseased leaf from the data sets created. Our proposed paper includes various phases of implementation namely dataset creation, feature extraction, training the classifier and classification. The created datasets of diseased and healthy leaves are collectively trained under Random Forest to

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classify the diseased and healthy images. For extracting features of an image we use Histogram of an Oriented Gradient(HOG). The accuracy of this paper is 70.14%.

Conclusion

The objective of this algorithm is to recognize abnormalities that occur on plants in their greenhouses or natural environment. The image captured is usually taken with a plain background to eliminate occlusion.

Plant Leaf Disease Detection using Deep Learning and Convolutional Neural Network Anandhakrishnan MG Joel Hanson1, Annette Joy2, Jerin Francis3(International Journal of Engineering Science and Computing, March 2017)

When pests affect plants and crops, it affects the agricultural production of the country. Usually farmers or experts observe the plants with naked eye for detection and identification of disease. But this method can be time processing, expensive and inaccurate. Automatic detection using image processing techniques provide fast and accurate results. This paper is concerned with a new approach to the development of plant disease recognition model, based on leaf image classification, by the use of deep convolutional networks.

Conclusion

The results presented in this section are related to training with the whole database containing both original and augmented images. After fine-tuning the parameters of the network, an overall accuracy of 96.3% was achieved, after the 100th training iteration (95.8% without finetuning).

WHEAT LEAF DISEASE DETECTION USING MACHINE Learning Method

Aarju Dixit, SumitNema (Vol.7 Issue.5 May-2018)

This paper is highlighting the outliers about the wheat leaf disease detection. India is the second larger producer of wheat after china. The wheat diseases are harmful to wheat production, but there are algorithms that can effectively identify common diseases of wheat leaves. The wheat diseases are generally viral, bacterial, fungal, insects, rust etc.

Conclusion

The algorithm was contrasted with other machine learning models for accuracy. Using Random forest classifier, the model was trained using 160 images of papaya leaves. The model could classify with approximate 70 percent accuracy.

Plant Disease Detection Using Image Processing Sachin D. Khirade, A.B.Patil (February 26 - 27,2015)

Identification of the plant diseases is the key to preventing the losses in the yield and quantity of the agricultural product. The studies of the plant diseases mean the studies of visually observable patterns seen on the plant. Health monitoring and disease detection on plant is very critical for sustainable agriculture. It is very difficult to monitor the plant diseases manually.

This paper discussed the methods used for the detection of plant diseases using their leaves images. This paper also discussed some segmentation and feature extraction algorithm used in the plant disease detection.

Conclusion

The accurately detection and classification of the plant disease is very important for he successful cultivation of crop and this can be done using image processing. This paper discussed various techniques to segment the disease part of the plant. This paper also discussed some Feature extraction and classification techniques to extract the features of infected leaf and the classification of plant diseases.

Crop Disease Detection using Machine Learning
Indian Agriculture

AnuradhaBadage (05 Sep 2018)Plant diseases are generally caused by pest, insects, pathogens and decrease the productivity to large scale if not controlled within time.

Agriculturists are facing lose due to various crop diseases. The proposed systemintimateshe agriculturist about the crop diseases to take further actions. The objective of the proposed system is to early detection of diseases as soon as it starts spreading on the outer layer of the leaves. The proposed system works in two phases: the first phase deals with training data sets. This includes, training both healthy and as well as diseased data sets. The second phase deals with monitoring the crop and identifying the disease using Canny's edge detection algorithm.

Conclusion

The proposed system periodically monitors the cultivated field. Crop diseases are detected in early stage by using edge detection and histogram matching. Machine learning techniques are used to train the model which helps to take a proper decision regarding the diseases. The pesticide as a remedy is suggested to the farmer for infected diseases to control it. In future the proposed system maybe implemented by adding extra services like nearby government stores, price list for the pesticides, nearby open market and many more.

Image-Based Plant Disease Detection Using Machine Learning

AshwinDhakal, SagarPandey, SujanAryal (June 2018)Machine learning becomes the most accurate and precise paradigms for the detection of plant's disease.

Leaves of Infected crops are collected and labelled according to the disease. Processing of image is performed along with pixel-wise operations to enhance the image information. It is followed with feature extraction, segmentation and the classification of patterns of captured leaves in order to identify plant leaf diseases. Four classifier labels are used as Bacterial spot, yellow leaf curl virus, Late Blight and Healthy leaf.

Conclusion

This research presents the study on different plant diseases detection using artificial neural network. The overall accuracy obtained was 96.59%. Hence showing strong promise of the deep learning approach for plant disease detection problems.

Including support vector machines, random forests, gradient boosting, k-means and DBSCAN, and is designed to interoperate with the Python numerical and scientific libraries NumPy and SciPy.

Plant Disease Detection model using aConvolutional Neural Network

OluvafemiTairu (November 2018)

Numpy

A library for the Python programming language, adding support for large, multi-dimensional arrays and matrices, along with a large collection of high-level mathematical functions to operate on these arrays.

Sklearn

A free software machine learning library for thePython programming language. It features various classification, regression and clustering algorithmsKerasKeras is an open source neural network library written in Python. It is capable of running on top of TensorFlow, Microsoft Cognitive Toolkit, or Theano. Designed to enable fast experimentation with deep neural networks, it focuses on being user-friendly, modular, and extensible.

Matplotlib

A plotting library for the Python programming language and its numerical mathematics extension. In this we have used CNN (Convolutional neural Network) it is type of feed-forward artificial neural network in which the connectivity pattern between its neurons is inspired by the organizations.

Conclusion

We detected disease of plants with accuracy of 96.77%.Table 1 shows comparative analysis of all methods discussed.

Comparative Analysis

Table 1: *Comparative Analysis.*

Sr no.	Paper title	Algorithm used	Accuracy	Advantages
1	Plant Disease Detection Using Machine Learning	Random Forest Algorithm	70.14%	By using Machine Learning we can detect disease earlier and can prevent it from getting spread all over the plant.
2	Plant Leaf Disease Detection using Deep Learning and Convolutional Neural Network	Convolutional Neural Network	95.08%	CNN helps us to detect disease in formed as well as in deformed images present in dataset.
3	Wheat Leaf Disease Detection Using Machine Learning Method	Support Vector Machine Classifier	-	By using Machine Learning we can detect disease earlier and can prevent it from getting spread over the leaf of wheat plant.
4	Plant Disease Detection Using Image Processing	Segmentation and feature extraction algorithm	-	Image processing has some clear advantages. Increased accuracy, higher speed and advanced colour shade processing technology.
5	Crop Disease Detection using Machine Learning: Indian Agriculture	Canny'sedge detection algorithm	-	
6	Image-Based Plant Disease Detection Using Machine Learning	Artificial Neural Network	98.59%	
7	Plant Disease Detection and its Solution using image classification	k-Means algorithm		

PROBLEM STATEMENT

One of the important sectors of Indian Economy is Agriculture. Employment to almost 50% of the countries workforce is provided by Indian agriculture sector. Therefore, in field of agriculture, detection of disease in plants plays an instrumental role. Plants are highly prone to diseases that affect the growth of the plant, which in turn affects the ecology of the farmer. In order to detect a plant disease at very initial stage, use of automatic disease detection technique is advantageous. The symptoms of plant diseases are conspicuous in different parts of a plant such as leaves, stem, flowers, buds, etc. Manual detection of plant disease using plant components is a tedious job.Potential losses of major world crops to pests, diseases and weeds have been estimated at approximately 70%(Oerke&Dehne 2004). Hence, it is required to develop computational methods which will make the process of disease detection and classification automatic with the help of plant dataset by using machine learning technology.

PROPOSED SYSTEM

First load dataset which is stored in rot directory i.e. plantVillage. Convert each image of dataset into array of matrix by using Python's in-built library cv2 and then these arrays are again converted into binary level through in-built library LabelBinarizer.

Convolution is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a filteror kernel. Convolution is the first layer to extract features from an input image. It preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a

filter or kernel. Figure 1 shows flowchart foe testing and training.

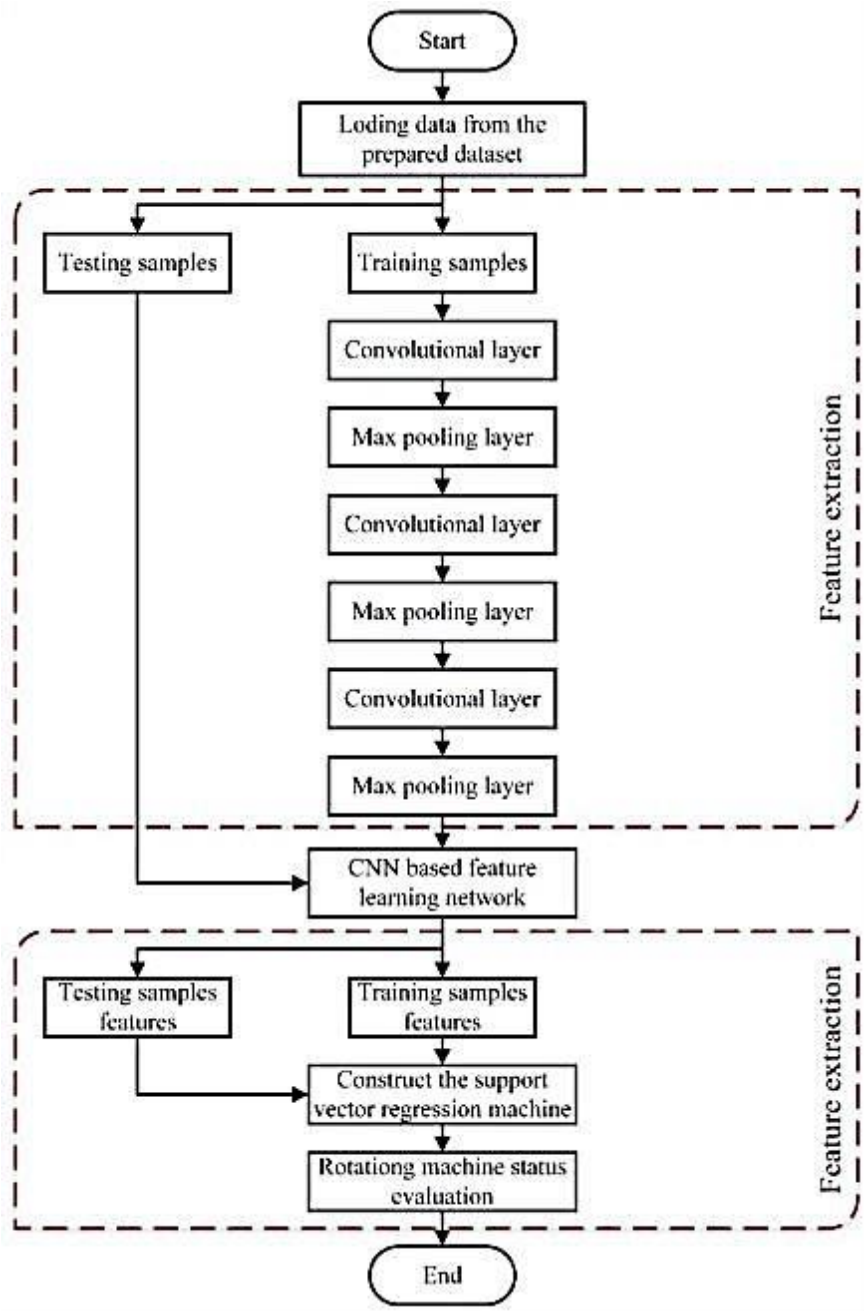

Fig. 1: *Flow Chart for Testing and Training.*

Algorithm

- **Step 1**: To load dataset.
- **Step 2**: Take 200 images as input from each folder of dataset.
- **Step 3**: perform image processing by converting each image into array of matrix then arrays are Converted into binary level by using labelBinarizer class.
- **Step 4**: Split the data into train and test set in the proportion of 80:20.
- **Step 5**: Now we have trained the model using CNNthat includes convolution layer, pooling layer, relu layer, fully connected layer.
- **Step 6**: Convolution is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data.

- **Step** 7: ReLU stands for Rectified Linear Unit for a non-linear operation. The output is
  $f(x) = \max(0,x)$.
- **Step 8**: Pooling layers section would reduce the number of parameters when the images are too large. Spatial pooling also called subsampling or down sampling which reduces the Dimensionality of each map but retains the important information.
- **Step 9:** The layer we call as FC layer, we flattened our matrix into vector and feed it into a fully connected layer like neural network.
- **Step 10**: Now, our training model is ready which we have dumped using inbuilt library i.e.
- Pickle we got accuracy of 94.16%.

Flowchart

Flowchart of training and testing is given below in Figure 1.

CONCLUSION

This application will serve as an aid to farmers (regardless of the level of experience), enabling fast and efficient recognition of plant diseases and facilitating the decision-making process when it comes to the use of chemical pesticides. Furthermore, future work will involve spreading the usage of the model by training it for plant disease recognition on wider land areas, combining aerial photos of orchards and vineyards captured by drones and convolution neural networks for object detection. By extending this research, the authors hope to achieve a valuable impact on sustainable development, affecting crop quality for future generations. The main goal for the future work will be developing a complete system consisting of server side components containing a trained model and an application for smart mobile devices with features such as displaying recognized diseases in fruits, vegetables, and other plants, based on leaf images captured by the mobile phone camera.

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