LEAF BASED PLANT DISEASE DETECTION USING DEEPLEARNING

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Abstract:

Agriculture is an important sector in any country, particular in India the agriculture is the major occupation. In the agriculture sector the major problem is plants affecting with the disease. When plants are infected with the disease, there will not be good yield, the fruits,grains,vegetables from the plants also will not be in a healthy conditions. So the demands for that particular plant products will decrease. Then the farmers expected profits will not be reached, instead they face the lot of losses. So the identifying the plant disease at right time before it spreads and affect the complete crops. Then after identifying the plant disease, the proper diagnosis should be taken to identify what is the disease the plant is effected and proper measures has to be taken to decrease the disease and control it. In this disease detection is the major task, then measures to be taken for the particular disease. The some of the previous approaches for this problem are identifying the plant disease with the nacked eye, using image processing techniques, using machine learning techniques. The previous work are proposed to identify the only few plant diseases. In this paper the identifying of the 38 classes of the diseases are proposed. These classes contain the various diseases of various plants. The proposed method used to identify these 38

Classes of diseases by using deep learning. The 38 classes contain both the diseased plants and healthy plant. In this the user interface is developed using the Django framework, by this the user can interact with the proposed system easily.

Keyword:

Deep learning, Digital Image, Plant diagnosis, Django, Convolutional Neural Network (CNN)

1. Introduction:

Plant pathogen is an entity that can incite the disease in plant. This disturb the normal physiological functioning of plant. With this the plant growth, productivity will decrease. Plant disease is the effecting of plant pathogen, then the particular plant is said to be infected with the disease. Some of the major plant pathogens are fungi, Bacteria, Nematodes, Viruses, insects. Plant pathology is the branch of Agriculture, which deals with the study of plant diseases. It also includes, importance, occurrence, symptoms, cause, etiology, disease cycle and management of diseases.

The some of the techniques used for detection of pathogens are Histopathological which is based on infected tissues, this is mostly done in cases of fungi, bacteria and nematodes, Serological which is based on interaction between antigen and antibody, Molecular techniques which is based on Nucleic acid of pathogens.

Histopathocogical technique is based on the symptoms, signs and syndrome of plant. In this visual observation of the plant through naked eye is used for diagnosis. All the plant pathogens can detect through characteristics symptoms, which they have produced in different plant parts.

The plant disease symptoms are two types Morphological symptoms, Histological symptoms. The Morphological symptoms are which are clearly evident on the body of plant. thesome of

Morphological symptoms are Necrosis, Hypoplasia, Hypertrophy.

Hypoplasia is the failure of plants or organs to develop fully.Necrosis is degeneration of protoplast followed by death of the tissue or organ or plant.Necrotic symptoms expressed before the death of the protoplast are called plesionecrosis. Necrotic symptoms expressed after the death of the protoplast are called holonecrosis. Leaf Spot is a well-defined or self-limiting grey,tan or brown necrotic lesion on a leaf, tiny spots.Leaf Blight is a rapid and extensive death of plant foliage. Leaf rot is decomposition ,putrefaction, softening,discoloration, and decay or disintergration of a succulent plant tissue as a result of fungal or bacterial infection.Leaf Rust is a small pustules of spots, usually breaking through the epidermis. Mildew is represent the chlorotic areas usually converted with pathogen as result of their vigorous growth.powdery mildew gives a dusty powdery appearance mostly of gray and white colour, causing fungus belong to ascomycetes family erysiphaceae. Leaf scab is roughened, crust like diseased area on the surface of a plant organ.

Based on the symptoms ,the disease of the plant should be identified. In this disease identification is based on nacked eye observation. To use this method the person who is diagnosing should have a strong knowledge on particular diseases, plant conditions. To use this on the large scale of agriculture land more number of the human resources are required. It is also difficult to know everything by a particular person. The accuracy of plant diagnosis will decrease. So the some of the work proposed alternative to this method are image processing, machine learning. In the image processing to identify the disease of the plant, they take the image of the plant that they want to test is taken and noise in the image is removed then features extraction is done on the image taken and based on the features they classify the disease of the plant. In the machine learning approach the classifier is trained with the diseased and healthy images of the plants, then new image of the plant is taken and feature of the image of plant are extracted and given to the classifier then the classifier predict the plant disease. The some of the limitations of the existing approaches are when the image dataset increases with the increase of the more number of disease classes the machine learning and image processing will not show the proper results.

2. Literature Review:

In this paper [1] the edge detection technique is used for identifying the diseased plant. In this they had collected the cotton leaf spot disease images and they extract the features of the cotton leaf image and using the image processing technique in this the edge detection is used to classify the healthy cotton leaf with the cotton leaf infected with the leaf spot disease.

In this paper [2] the pattern recognition technique has been used to diagnosis in the plant. In this the rice diseases are classified into diseased rice and healthy rice based on the image by extracting the features from the image.

In this paper [3] the cotton disease are classified. The author has used the Eigen values and Eigen vectors technique for the classification. The model can classify the diseased cotton and healthy cotton based on the leaf image provided as the input.

In this paper [4] the author has proposed the texture feature to classify the diseased plant. The author has mentioned the technique to find the unhealthy region of the leaf. With the help of the texture feature the author has classified the healthy and diseased leaf.

In this paper [5] the author has proposed method the Grading method to classify the diseased crop from the healthy crop with the help of the image processing technique. The image is taken as the input and features are extracted and the classifier trained with the grading method is used to classify with the feature to identify whether the plant is diseased or healthy plant.

In this paper [6] author has proposed the machine learning based models to classify the weeds. In this the Naive Bayes, support vector machine, and c4.5 models are implemented to classify the weeds from the crop with the collected dataset trained on the three models proposed and evaluated.

In this paper [7] author has proposed the machine learning models to classify the plant diseases. The author has implemented the some of the machine learning algorithms used are logistic regression, support vector machine, k –nearest Neighborhood, CART, Random Forests, Naive Bayes among the models proposed the author got the random forest the highest accuracy.

In this paper [8] the author has proposed machine learning and some neural network models. The author has compared the various machine learning model and neural network models.

3.Proposed method:

In this paper the deep learning technique is used to implement the plant disease detection system, that take the image of leaf of the plant and it need to detect the is leaf given is infected with the disease or not. If it is detected that the leaf is infected with the disease, then it need to suggest the precautions and measures to be taken to eradicate or to control the disease in plant. To implement the proposed system , the convolution neural Network is used to build the model to detect the disease.

3.1 Dataset:

The dataset is collected to train and test the designed model and a fraction of dataset is used for further prediction to test the performance of the model designed. The data is collected from the kaggle plant village dataset. This is collected and further augmentation is performed to increase the size of the dataset. This dataset contain the images of the plant in total there are 38 classes. This 38 classes consists of both the diseased and also the healthy leaf images. The dataset contain about 87k RGB images. The dataset is split into the training set and testing set. The 80 percent of the dataset is used for the training and 20 percent of the dataset is used for the testing. Further 33 images of the each category of the dataset are used for further testing of the model.

Table: Dataset

S.NO	Category Name
1	Apple___Apple_scab
2	Apple___Black_rot
3	Apple___Cedar_apple_rust
4	Apple___healthy
5	Blueberry___healthy
6	Cherry_(including_sour)___Powdery_mildew
7	Cherry_(including_sour)___healthy
8	Corn_(maize)___Cercospora_leaf_spotGray_leaf_spot
9	Corn_(maize)___Common_rust_
10	Corn_(maize)___Northern_Leaf_Blight
11	Corn_(maize)___healthy
12	Grape___Black_rot
13	Grape___Esca_(Black_Measles)
14	Grape___Leaf_blight_(Isariopsis_Leaf_Spot)
15	Grape___healthy
16	Orange___Haunglongbing_(Citrus_greening)
17	Peach___Bacterial_spot
18	Peach___healthy
19	Pepper,_bell___Bacterial_spot
20	Pepper,_bell___healthy
21	Potato___Early_blight
22	Potato___Late_blight
23	Potato___healthy
24	Raspberry___healthy
25	Soybean___healthy
26	Squash___Powdery_mildew
27	Strawberry___Leaf_scorch
28	Strawberry___healthy
29	Tomato___Bacterial_spot
30	Tomato___Early_blight
31	Tomato___Late_blight
32	Tomato___Leaf_Mold
33	Tomato___Septoria_leaf_spot
34	Tomato___Spider_mites Two-spotted_spider_mite
35	Tomato___Target_Spot
36	Tomato___Tomato_Yellow_Leaf_Curl_Virus
37	Tomato___Tomato_mosaic_virus
38	Tomato___healthy

3.2 Model implementation:

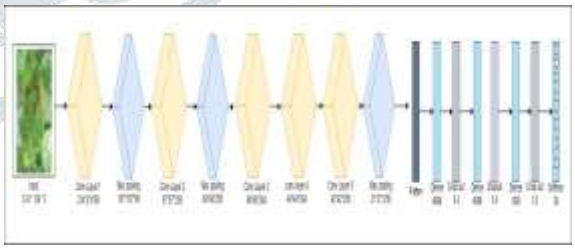

Figure 3.1: Architecture of proposed model

The Convolutional Neural Network is used to build the model. The sequential method is used to model the proposed method. Sequential model is appropriate for a plain stack of layers where each layer has exactly one input tensor and one output tensor. The architecture of the model is build using the convolutional layer, maxpooling layer, flatten layer, dense layer, dropout layer, softmaxlayer. The above figure depict the how the layers are arranged and order, input to the layer, output from

the layers. The first layer is the Convolution layer with the images as the input, and the 'relu' as the activation Function in this padding is keptvalid. Next the Maxpooling layer is created with the size of 2*2 and the stride of 2*2,with the valid padding. Then the output of the max pooling layer is normalized with the Batch normalization layer. In this way another 2 layers of convolution, max pooling followed by batch normalization is done.Then the flatten layer is implemented. This layer flatten all the outputs of the Batch Normalization layer. Then the flatten output are given to the next created dense layer.The Dense layer with 4096 neurons with the activation function 'Relu' is created.Then the drop out layer is created in order to reduce the number of output from layer to layer.Then a Batch Normalization is created.In this way another 2 layers of dense,dropout followed by Batch normalization is created.Then at last a last layer a dense layer is created with the 38 neurons , with the activation function 'Softmax'.The last layer give the output which specify the one of the 38 classes of diseases of the plant.

After creating the model the model is trained with the training data that has created in the data processing step. The model is compiled with the keras compile method. The sarcastic gradient descent optimizer is used for the compiling the model. Gradient Descent is a optimization technique that is used in the training the model. This is better to use when compared to the OLS, when there are large number of features and complex relationships.

The Trained model is evaluated with the testing data. Then after the evaluation the model is saved for the further predictions. To make the system easy for the user to interact the web application is developed with the help of the Django framework. The web application take the user input and with the help of the saved model it identify whether the given image of the leaf is healthy or diseased leaf. If it identify that the input is diseased plant leaf then it also give the measures to be taken to further control or eradicate the disease in crop. The measures and precautions are explicitly programmed with the help of the data available in the internet about the diseased of the plant.

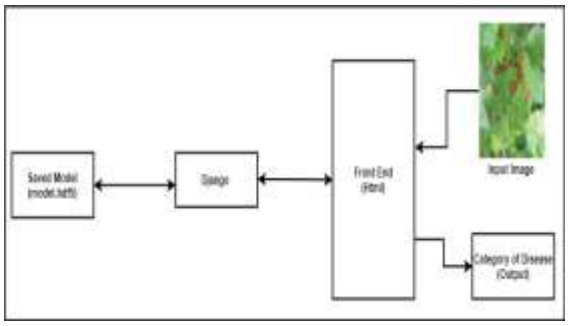

Figure 3.2: Proposed Model workflow

4. Results:

Figure 4.1: Home page

Figure 4.2: Upload the image

Figure 4.3: Disease of plant and Measures to be taken

5. Conclusion:

This paper has proposed the Deep Learning model for the plant disease detection with the user interface developed using Django. The model is able to classify the 38 category of diseases. The proposed method has overcome the limitations of the previous work. The system developed is also easy to maintain and interact. The model also give measures and precautions to be taken which are explicitly programmed based on the disease identified. The future scope of the proposed method is they need to increase the number of category of diseases and in the proposed work the precautions and measures are explicitly programmed instead they might be trained also with the image dataset.

Reference:

[1] Revathi, P., and M. Hemalatha. "Classification of cotton leaf spot diseases using image processing edge detection techniques." 2012 International Conference on Emerging Trends in Science, Engineering and Technology (INCOSET). IEEE, 2012.

[2] Phadikar, Santanu, and Jaya Sil. "Rice disease identification using pattern recognition techniques." 2008 11th International Conference on Computer and Information Technology. IEEE, 2008.

[3] Gurjar, Ajay A., and Viraj A. Gulhane. "Disease detection on cotton leaves by eigenfeature regularization and extraction technique." International Journal of Electronics, Communication and Soft Computing Science & Engineering (IJECSCSE) 1.1 (2012): 1.

[4] Arivazhagan, Sai, et al. "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features." Agricultural Engineering International: CIGR Journal 15.1 (2013): 211-217.

[5] Tian, Youwen, Lide Wang, and Qiuying Zhou. "Grading method of crop disease based on image processing." International Conference on Computer and Computing Technologies in Agriculture. Springer, Berlin, Heidelberg, 2011.

[6] Mursalin, Md, et al. "Performance Analysis among Different Classifier Including Naive Bayes, Support Vector Machine and C4. 5 for Automatic Weeds Classification." Global Journal of Computer Science and Technology (2013).

[7] Ramesh, Shima, et al. "Plant disease detection using machine learning." 2018 International Conference on Design Innovations for 3Cs Compute Communicate Control (ICDI3C). IEEE, 2018.

[8] Shruthi, U., V. Nagaveni, and B. K. Raghavendra. "A review on machine learning classification techniques for plant disease detection." 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS). IEEE, 2019.