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Image Processing based Arecanut Diseases Detection Using CNN Model

Meghana D R[1] and Prabhudeva S[2]
4th Semester, Department of Master of Computer Applications[1]
Professor & Director, Department of Master of Computer Applications[2]
Jawaharlal Nehru National College of Engineering, Shimoga, Karnataka, India

Abstract: *Areca nut is one of the commercial crop grown in many regions of our country. India has got second rank in production and growing of arecanut. Throughout the life span areca nut can be affected by many of the diseases like mahali (koleroga), yellow leaf disease and stem bleeding etc., these diseases are affected by leaf, trunk, nuts of the arecanut tree. In this paper, the proposed work is to detect these diseases using Convolutional Neural Network (CNN) and recommends solutions for it. CNN is one of the best deep learning algorithm, it takes image as a input and assign the learnable weights to objects of the images and learns the result to classify the images one from the another. The dataset consists of 241 both diseased and healthy images for train and test the CNN model. Here, categorical cross entropy used as a loss function, adam as an optimizer function and accuracy as metrics for compilation of a model. To achieve the high accuracy and minimum loss, 50 epochs used to train the model. This proposed model can achieved the high accuracy of 93.3% accurate in detecting the diseases in areca nut.*

Keywords: Arecanut disease, Deep Learning, Image Processing, Convolutional Neural Network (CNN)

I. INTRODUCTION

Agriculture is one of the main occupations of the peoples. The people always stand behind the agriculture. Without agriculture, we cannot live. India is the second largest country for the production of agriculture. Thus, India is proven to be a leading nation in agricultural and productivity. The agricultural field faces the many of the problems because of the environment climate condition, insufficient water supply, insufficient fertilizers etc. This problem causes the diseases in the crops and also decreases the crop yields and quality. In this work is based on areca nut crops. Areca nut is one of the tropical crop and another name of areca nut is a betel nut. India is one of the largest areca nut growing country. Areca nut is also infected by the several diseases and the most common diseases found are:

1. **Mahali (koleroga):** This mahali disease is caused by the fungus ***Phytophthora araceae***. These diseases are accurse mainly in high rainfall areas like Kerala and Karnataka. Darken nut, fallen nut and lighter in weights these are the symptoms of this disease.
2. **Yellow leaf spot disease**: In this disease case yellowing accurse in the outer whorls and spreads to the whole leaf, and the leafs drops down covering the stem.
3. **Stem bleeding**: This disease is caused by the ***Thielaviopas Paradoxa*** fungus and affected by the arecanut trunk area. The color of the trunk become change and rust colored liquid bleeding from the infected areas of the trunk.

To detect these diseases carefully is a very big challenging tasks; it requires many instruments and laboratories. However it is not possible to detect the disease in a early stage. To avoid this CNN model and deep learning algorithm to detect the diseases in early stage and suggest the remedies for the particular diseases.

II. LITERATURE SURVEY

Anilkumar et al [1], has used the "Deep Learning algorithm" to identifies the disease in a arecanut. It can achieve the 88.46% of accuracy for identifying the arecanut disease. Baradwaj [2], described that grading the arecanut using texture based and block wise local binary pattern for feature extraction. Here, as proposed by the dataset by using local binary pattern histogram for areca images. This proposed system contains Support Vector Machine (SVM) classification technique to classify the images in a test and train dataset. Dhanuja K C [3], described a texture based grading for the arecanut and using Nearest Neighbor algorithm to extract the feature of the arecanut. Here, it takes image as a input and

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make image acquisition and color contrast using HSI (Hue saturation Intensity) model and this model extract the feature and detect the spot regions of the arecanut.

Dhanti, Suresh [5], used a technique for classification and segmentation of raw arecanut. In this paper classification of areca nut into two classes based on color includes three steps: i. Segmentation, ii. Masking and iii. Classification. In the segmented region of the arecanut the classification can be done by red and green color. Rinu R et al [6], has published a paper which contains Deep Learning, VGG16 model and Convolutional neural network to detect the plant diseases. By using this model, this work achieved the accuracy of 94.8%.

S B Mallikarjuna et al [7], has published a paper named- 'Multi gradient direction' based deep learning model for arecanut disease identification. The proposed system explores the multi Sobel directional mask to extract the fine details in the images of diseased arecanut. In forward it extract the enhanced images using Otsu thresh holding.

III. PROPOSED METHODOLOGY

Areca nut is infected by the many of the diseases due to different environmental conditions such as humidity, temperature, insufficient food etc. The aim of this project is to build the image classification tool for detecting the diseases in the early stage and positively identifies the diseases.

Here, CNN algorithm is used to detect the diseases and it is achieved the high accuracy. The following figure1 illustrates the work flow of the system.

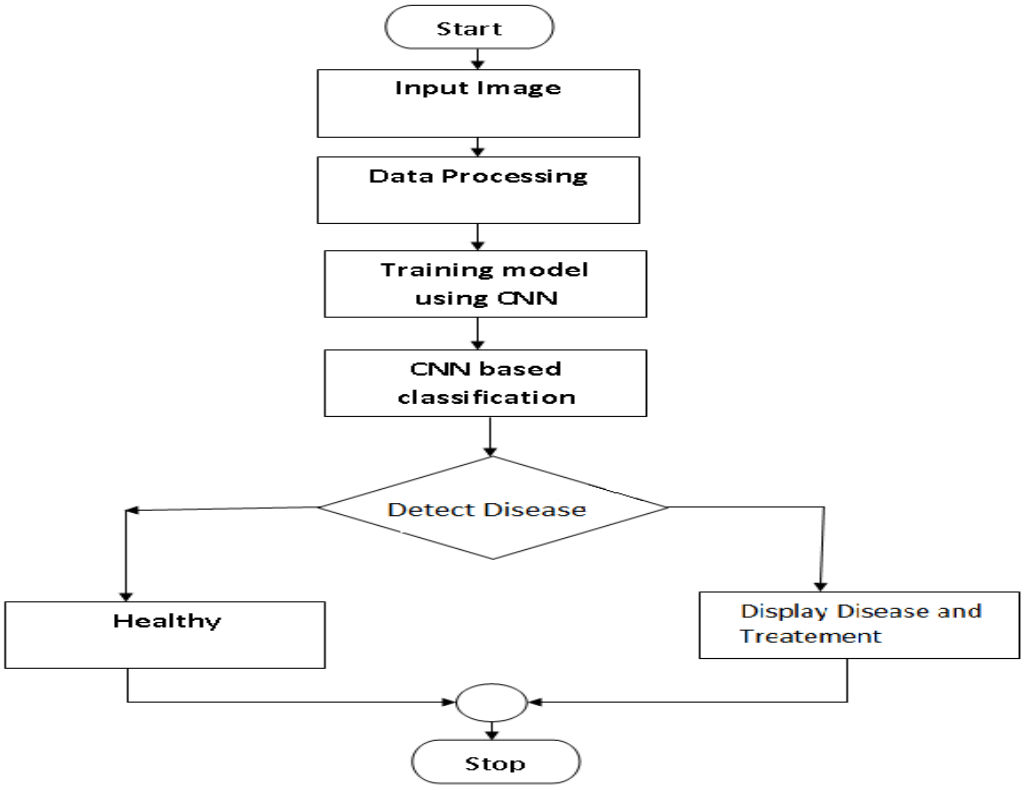

Figure 1: Workflow Diagram

3.1. Dataset

In this work, dataset is collected from the **kandi** website for detecting the diseases in the arecanut. The dataset consist of **241** images which contains both healthy and diseased images. The dataset can be divided into test, train and val. The train dataset consists of **187** images belonging to **6** classes and Val dataset consists of **39** images belonging to **6** classes. Some of the sample images are highlighted in the figure 2 below.

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Category	*Images*
Healthy_Leaf	19
Healthy_Nut	51
Healthy_Trunk	32
Mahali_Koleroga	03
Stem_bleeding	62
Yellow_leaf spot_disease	20

Table: 1 Train Dataset Breakup

Fig 2: Sample images in the dataset

3.2. Preprocessing

The data preprocessing can be done by the images in the dataset. Preprocessing includes image resizing, image reshaping and converting image to array. The computer was not able to recognize the images so that we are using numerical python (**numpy**) can convert the images into array. Each pixels images are ranging from 0 to 256. The preprocessing can be done by before training the neural network model.

3.3. CNN Based Classification

CNN is the best deep neural network model (see the figure 3) and multilayered architecture. It contains the input, output and hidden layer that can be used to classify the images. It is one of the good methods for computer vision applications. Compare to other algorithms the CNN significantly need a less preprocessing.

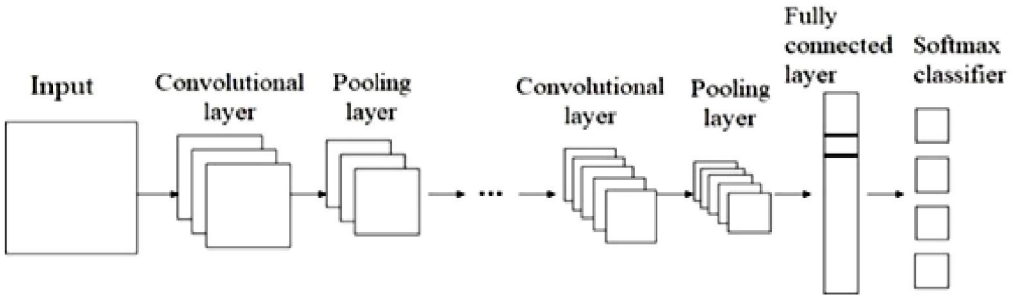

Figure 3: CNN Model

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The CNN is developed using three layers: Covolutional layer fully connected layer and pooling layer.

1. Covolutional Layer can be made up of set of kernels or a filters. The filters can be applied to the input image. This Conv layer model can be used to create the more complex models.
2. Pooling layer it can reduce the size of the input image and it requires the less memory. There are two types in pooling one is the Max pooling it takes the maximum value and another one is the Average pooling it takes the average value.
3. 3. Fully connected layer was fully connected to all the neurons in the previous layer. It can take all the features in the previous layers to classify the images.

3.4 Training the Model

The dataset consists of 241 both healthy and diseased images for test and train the ConvNet model. The test and train data can be divided the ratio of **80:20**. Here, **adam** as an optimizer function categorical cross entropy used as a loss function and accuracy as metrics for compilation of a model. To achieve the high accuracy and minimum loss we used the 50 epochs to train the model and to get the high accuracy. This proposed model can achieved the accuracy of 93.3% detecting the diseases in areca nut**.**

IV. RESULT ANALYSIS

Here some sample images of arecanut disease detection as shown in figure 4. Further in figure 5 Shows the application predicting the result as healthy nut. The figure 6 shows the application predicating the yellow leaf spot disease and display the treatment.

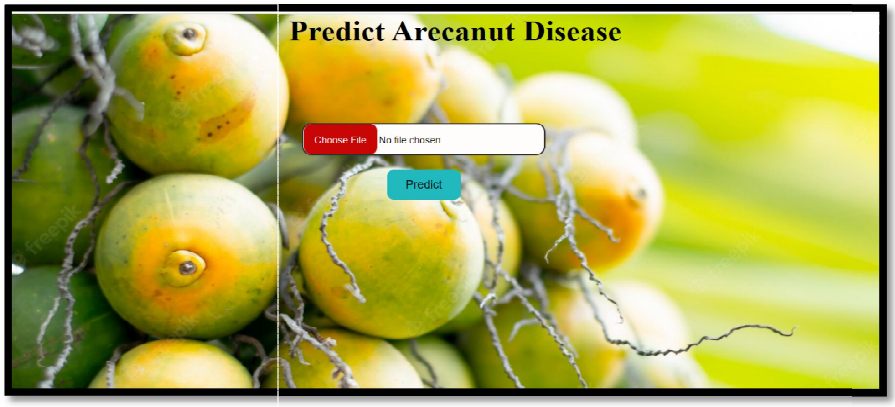

Figure 4: GUI of the arecanut disease detection

Figure 5: The application predicting the result as Healthy nut

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Figure 6: The application predicating the yellow leaf spot disease and display the treatment

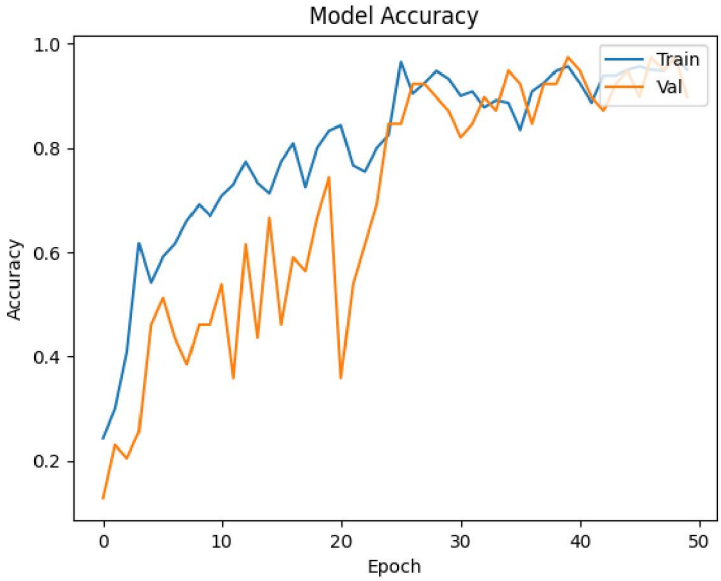

Figure 7: Accuracy v/s epochs graph

The above graph indicates two curves. The blue curve indicates that training accuracy and the orange curve indicates that testing accuracy. This graph shows the 93.3% of accuracy as in the figure 7

V. CONCLUSION

This project is mainly concentrate on early detection of diseases in arecanut. This project work contains 241 images in the dataset. The deep learning algorithm CNN is used to detect the different type diseases in the areca nut such as mahili, stem bleeding yellow leaf spot and display the treatment. The dataset is trained by the neural network. The GUI is designed for this system and it permits users to choose the images in the dataset. After selecting the image the particular image get loaded and predict the disease and display the treatment for the diseases. This can encourage the farmers to use this type of technologies and detecting the diseases in the early stage and using some precautionary measures/pesticides to cure diseases and get high yield of the crops in their land.

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