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AUTOMATIC IDENTIFICATION OF PLANT HEALTH USING RASPBERRY PI AND NEURAL NETWORK

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ABSTRACT:

The goal of this analysis is to introduce a system that uses a convolutional neural network technique to mechanically diagnose plants leaf health. Separation supported selection of applicable options like color, texture of pictures created mistreatment Deep Learning Techniques . Green plants square measure a great deal vital to the human environment they type the idea for the sustainability and future health of environmental systems. so it's vital to grow healthy plants. The disease can be cured if it's celebrated within the earlier stage. We have planned a system using raspberry pi to find healthy and unhealthy plants. We have used a tensor flow tool for numerical computation. It is often utilized in Associate in Nursing controlled atmosphere farms such it detects the signs of malady whenever they seem on the leaves of the plant.

INDEX TERMS:

Identification leaf Health, Convolutional Neural Network (CNN), Deep learning, leaf dataset, Epochs, Hidden Layers, Tensor flow , Keras , Raspberry Pi, Pi Camera.

I. INTRODUCTION:

India is a cultivated country and concerning seventieth of the population depends on agriculture. Farmers have a giant variety of diversity for choosing varied appropriate crops and finding the acceptable pesticides for plants.

malady on plants results in the numerous reduction in each the standard and amount of agricultural product [1][1]. The studies of disease talk over with the studies of visually evident patterns on the plants. Watching of health and malady on plants plays a crucial role in prospering cultivation of crops within the farm. In the time period the watching and analysis of plant diseases were done manually by the experienced person within the field [3][4].

Figure1. Leaf with Diseases [3][4].

The system uses raspberry pi to observe Healthy and Unhealthy leaves by capturing pictures and finding accuracy [8] .

II. Architecture of Deep Convolutional Neural Networks:

Convolutional neural networks (CNN, or Convolution Neural Network) are a category of deep high-frequency neural networks commonly used in image analysis. CNNs use a type of multi-layer perceptron designed to require minimal processing. convolutional networks are inspired by the biological process of connection patterns between neurons, such as the visual field of animal tissue [4][1]. It was done. Cortical neurons respond individually Because the receptor fields of different neurons are intertwined to cover the entire visual field, the CNN is pre-data-composed compared to other algorithms compared to other algorithm networks. It requires less processing. Knowledge before reading the field of view and this independent functional design effort of humans are great benefits. There is an app for photos and videos recognition, recommender systems and natural language processing.

The CNN design of the neural network expressly assumes that the input is a picture so you'll code bound properties into the design. This makes the implementation of forward functions additional economical and considerably reduces the quantity of parameters within the network [6][4]. Layer description with the convolutional neural network delineated below.

• Convolutional layer: Convolution is the core building block of a convolutional network, doing most of the computationally tough tasks. 3 information (depth, stride and padding)

• Liquid ecstasy Pooling Layer: liquid ecstasy pooling may be a sample-based discretization method. liquid ecstasy pooling is finished by applying a liquid ecstasy filter to (usually) non-overlapping sub regions of the initial illustration.

III. EXPERIMENT:

A. DATA DESCRIPTION :

We use the data set Cotton Disease Dataset as the basis for the evaluation of the leaf health recognition task [12][3]. The data used in the project. The dataset enables automatic learning researchers with new ideas to dive straight into an important technical area. without the need to collect or Generate new data sets and enable a direct comparison with the effectiveness of previous work. The data set is generated with Leaf image, which consists of Healthy and Unhealthy with different classes. The data set is divided into two parts: one large set is used to train the deep neural network and another example is used for validation. Another set is used and called the test set.

The dataset is divided into two parts:
1951 samples are used for training the deep neural network and 1951 samples for validation [7][1]. All models and training are done with the Keras with TensorFlow as a deep learning library using high-end GPUs such as T4 and P100 and TPUs. The Adam optimizer was used for all architectures, and the loss function was the categorical cross-entropy function. We also used ReLU activation functions for all layers, except the last dense layer where we used SoftMax activation functions. We used a minimum batch size of 32 and a learning rate of 0.001.

```
Model: "sequential"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
conv2d (Conv2D)              (None, 148, 148, 32)      896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (None, 74, 74, 32)        0
_________________________________________________________________
conv2d_1 (Conv2D)            (None, 72, 72, 64)        18496
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (None, 36, 36, 64)        0
_________________________________________________________________
conv2d_2 (Conv2D)            (None, 34, 34, 128)       73856
_________________________________________________________________
max_pooling2d_2 (MaxPooling2 (None, 17, 17, 128)       0
_________________________________________________________________
conv2d_3 (Conv2D)            (None, 15, 15, 256)       295168
_________________________________________________________________
max_pooling2d_3 (MaxPooling2 (None, 7, 7, 256)         0
_________________________________________________________________
dropout (Dropout)            (None, 7, 7, 256)         0
_________________________________________________________________
flatten (Flatten)            (None, 12544)             0
_________________________________________________________________
dense (Dense)                (None, 128)               1605760
_________________________________________________________________
dropout_1 (Dropout)          (None, 128)               0
_________________________________________________________________
dense_1 (Dense)              (None, 256)               33024
_________________________________________________________________
dropout_2 (Dropout)          (None, 256)               0
_________________________________________________________________
dense_2 (Dense)              (None, 2)                 514
=================================================================
Total params: 2,027,714
Trainable params: 2,027,714
Non-trainable params: 0
_________________________________________________________________
```

FIGURE 2. All the layers of the model with model summary

B.THE METHOD OF EVALUATION :

In This paper we have built a DCNN from scratch:

(a). Dividing the dataset into two parts i.e., training dataset (1951 leaf image) and validation dataset (400 leaf image).

(b). Our DCNN model contains 1 input layer, multiple conv2D layers , 2 Dense layers and 1 output layer with a few dropout layers in between.

(c). On training and Validation dataset the DCNN model is trained.

(d). After training, true-positive, false-positive, true- negative, false-negative of the test set were recorded successively.

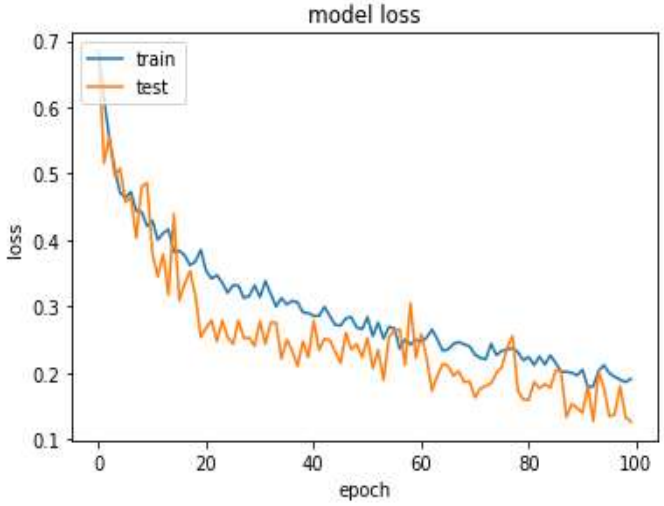

FIGURE 3. Training vs Validation loss of CNN Model.

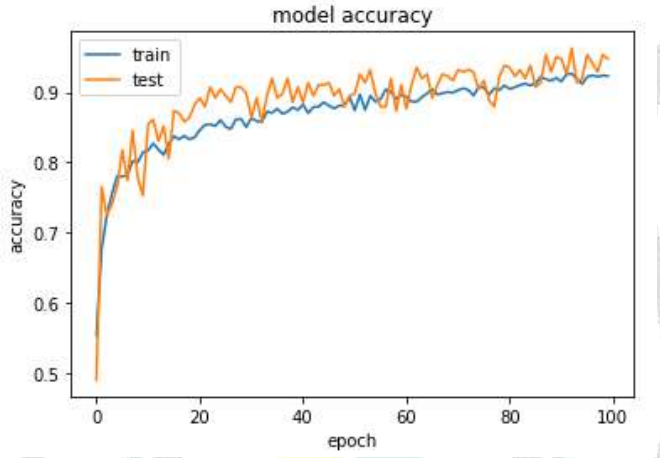

FIGURE 4. Training loss vs Validation accuracy of CNN Model.

C. RESULT ANALYSIS AND DISCUSSION :

Our task was to train a deep convolutional neural network (CNN) that could identify and classify leaf images. We used the Lead Disease Dataset from which we have selected 2 categories [Diseased Leaf,Fresh Leaf], a dataset containing leaf & plant images in the form of arrays from these 2 categories. leaf from each category came in some numbers of leaf images with different angles.

DL methods continue to show enormous promise in improving identification sensitivity and accuracy, especially for short-time observations However, DCNN can automatically extract features so that it can save a lot of time and labor [14]. After evaluation of the model on the test dataset the results are recorded. Accuracy of each signal is as follows:

The overall value accuracy of the model is 97.90%.

data set Cotton Disease Dataset as the basis for the evaluation of the leaf health recognition task .The data set is generated with Leaf image, which consists of healthy and Unhealthy with different classes. The data set is divided into two parts: one large set is used to train the deep neural network and another example is used for validation. Another set is used and called the test set. In the next step, we need a set of images to teach the model and upload to using raspberry pi which can detect disease infected leaves. The system has many vertical int leaf detection [7]. So far we have achieved in detecting the disease affected leaf. In future we will segregate the disease whether it is affected by bacteria, fungi or viral and specify the solution to the farmer in the field.

IV. CONCLUSION:

The planned project subsists by grouping the required knowledge for numerous cotton diseases by examining different sectors. Image process techniques and classification techniques area units wont to determine cotton leaf diseases. Factors like color, form and texture area unit helpful in pattern recognition, classification, free accuracy and errors area unit calculated. Future work is going to be to make AN economical, sturdy detection system for automatic detection of assorted plant diseases. Classifiers are going to be supported with a variety of various options or a mixture of different algorithms for quick diagnostic tests.

The project deals with distinguishing the illness affected leaf. This is often achieved through the Convolutional Neural Network algorithmic rule. If the leaf is laid low with illness then the data is shared through the mail. This helps the farmer to search out an answer while not coming back towards the sector.

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