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PLANT DISEASE DETECTIONS USING CNN

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ABSTRACT

Plant disease is a significant factor that affects plant growth and yield leading to a loss in money and time. A professional farmer can identify the disease type with his experience. Still, a new one has to rely on an agricultural expert, which takes more time and risks disease spreading to remaining crops. We have chosen the paddy crop among variousplant types as it is the widely cultivated plant type in the South-Asian subcontinent. We have primarily determined three common disease types, namely Leaf blight, Brown spot, and Blast. Our solution is to identify the disease type from paddy leaf images using a Convolutional neural network(CNN). Our dataset has 1100 images, of which 700 are taken for training and 400 for testing. We use the TensorFlow Keras model for image pre-processing and classification, in which the image will be resized and converted to RGB. We operate transfer learning methods for classification as it takes less time compared to other algorithms. Finally, the disease type is displayed tothe user.

Keywords: *Convolutional neural network, Tensor Flow, keras, RGB, Transfer learning, pre-processing.*

1. INTRODUCTION

Agricultural growth is a significant instrument that serves as a backbone for many countries. By 2050, agricultural development is expected to feed at least 9.7 billion people. The agricultural industry has a huge impact on people's earnings all around the world. [1] However, agricultural development entails a number of hazards, including adequate irrigation, illness detection, and weed control, among others. Crop yields may be severelyreduced as a result of frequent climate fluctuations and other meteorological variables. [2]

Rice is one of the most frequently grown and significant crops in India and the South Asian subcontinents. Rice diseases have a huge impact on rice output. As a result, identifying rice illnesses is critical to maintaining food security as well as higher yields, higher quality, and higher efficiency of rice. Traditional rice disease detection methods need a large number of specialists, expertise, and knowledge. [3]One of the most difficult issues in agriculture is early diagnosis of rice leaf diseases. As a result, there is a requirement for automatic rice disease detection in rural areas using readily available mobile devices.[4]Our model detects the disease type the plant is infected with. The illness that the plant may be suffering from is divided into three types:leaf blast, bacterial blight and brown spot[1]. For illness prediction and categorization, the model employs a Convolutional Neural Network[1]. Because it is more efficient to deal with pictures, the convolutional neural network was chosen. Three classes with three different illness kinds are included in the dataset. The goal of using deep convolutional networks is to give farmers with an easy-to-use approach for detecting illnesses at an early stage[3]. The suggested model is written in Python, which is the finest programming language for deep learning. The suggested paradigm is implemented in Google Colab,Google's cloud platform.

Fig 1: Represents a diseased paddy crop

These are the following contents that will be discussed in this paper. Literature survey has been taken with different ideas in the field of agriculture In Section ll. Background study in Section lll Propose model and implementation are presented in Section lV. Conclusion and References are given in Section V.

2. RELATED WORK

Suraksha et al. [5] present a technique that uses data mining & image processing techniques to predict the disease that the paddy crop is suffering from. Using feature extraction and data mining approaches, they offer a model for detecting illnesses that affect paddy plants in the study.

Using CNN and SVM classifiers, R Rajmohan et al [6] suggested a technique for detecting the sickness that the crop is affected by. For image processing, their model employs feature extraction and an SVM classifier. They've shot 250 photos thus far. They tested 50 photographs and trained the model with the remaining 200 images. They've also created a mobile app that takes a picture of the infected plant, zooms it in and crops it, then uploads it and sends a notification to the user.

Lipsa Barik [7] suggested an image processing technique for identifying Rice disease regions. The author has suggested a model that not only recognizes the disease that is afflicting the rice plant, but also the diseased location. The author employed image processing and machine learning techniques such as Nave Bayes and Support Vector Machines to classify the data. Following the forecast, the severity of the sickness is determined, and it is then divided into various categories.

Jayanthi, G. et.al [8] proposed the model in analysing the automatic rice disease classification with the help of image processing techniques. This paper proposes a detailed study regarding the different image classification algorithms.

3. TYPES OF PADDY PLANT DISEASE

The primary aim of this study is to identify the illness that is afflicting the paddy crop. The illnesses that we considered are detailed below.

1) Leaf blast:

Leaf blast is one of the most serious diseases that affects rice plants. It can damage different sections of the leaf as shown in Fig 1. This disease is more common in areas with regular rains, cold temperatures, and low soil moisture. Spots with dark green borders can be used to identify this illness. Brown spots can readily mistaken with them. When completely developed, this disease has the potential to destroy the entire leaf. It may be controlled by flooding the field as often as feasible. It can also be controlled by applying nitrogen fertilizer in two or more treating methods [11].

2) Bacterial leaf blight:

The white and yellow stripes on paddy leaves caused by bacterial leaf blight disease are clearly identifiable. By looking the youngest leaf, which will appear to be pale yellow , we can tell if the plant is affected by bacterial leaf blight. Excess nitrogen fertilizer should be avoided, and after harvesting the crop, stubble and straw should be ploughed into the soil to prevent the plant from being damaged. [9].

3) Brown spot:

The brown spot disease infects paddy crops, causing black patches on the leaves. The most common symptoms are the loss of a substantial percentage of the leafs, the death of seedlings, and the appearance of brown patches or black spots. It's a fungal infection. It results in a reduction in both number and quality. Brown spot is responsible for 5% of overall yield loss in South and Southeast Asia[2]. By feeding the rice plant with the proper nutrients, we can ensure that it is not infected with this illness. Chemically treating seeds can also be beneficial since it reduces the risk of infection[11].

4) Proposed model:

Neural networks are a sophisticated algorithm series that uses copy processing to identify a link between a collection of data. They're commonly utilized in corporate enterprise planning, trading, and analytics, as well as medical and product maintenance. They are the most often utilized fraud detection in commercial applications, and they also play an important role in the medical world by identifying illnesses including brain tumors, breast cancer, and diabetes. [5]Convolutional neural network(CNN) is the best form of neural network for working with pictures out of all the other varieties. Convolutional neural networks come in a variety of designs, including ResNet, LeNet-5, Alexnet, Dense Net, Inception, and VGG 16t, to name a few. These designs are recognized for their superior feature extraction, which may be used to image classification, picture segmentation, object recognition, and other tasks.We picked transfer learning from among these architectures since it allows us to deal with a large number of pictures. The transfer learning technique focuses on using the model's past expertise with other problems to solve an issue. It is a common deep learning technique that use a pre-trained model that has beentrained on a different issue to tackle problems across a broad range of domains, such as Image Processing. The Developed Model Approach and the Pre-Trained Model Approach are the two most popular ways to transfer learning..i)Selecting source task,ii)building source model,iii)reusing the model,iv)adjusting the model are the four key phases in the developed model approach that must be followed when utilizing transfer learning. Selecting the Source model, reusing the model, and adjusting the model are the three key phases in the Pre-trained Model Approach. [10] Transfer learning is frequently utilized to solve predictive

modeling issues using picture data. When compared to other CNN models, this technique is frequently utilized since it typically produces superior results. Transfer Learning methods have three primary advantages: a higher start, a steeper slope, and a higher asymptote. [10]

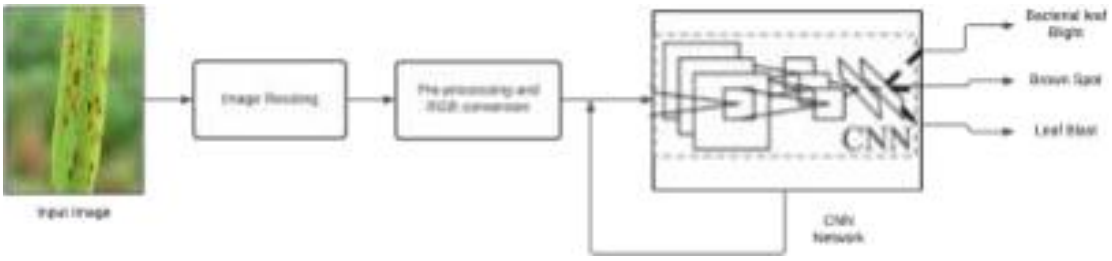

Fig 2: Represents the architecture of proposed system

4. IMPLEMENTATION

1) Image Augmentation:

For better performance and learning experience in neural networks, a vast number of datasets are used. Image augmentation methods reused to virtually enhance the quantity of the training data, which aids the performance of the neural network classifier. It generates training images artificially through combining numerous processing methods such as shears, flips as in Fig :2, arbitrary rotations and shifts such as left and right shifts.

2) Convolution step:

In mathematics, convolution is a derivative function that derived from two supplied functions through integration and expresses how the shape of one is modified by the other. To obtain the feature matrix, a kernel matrix is taken and multiplied with the image matrix in the convolution stage. There are 13 Convolutional Layers in total, with 2 Convolutional Layers of, 2 Convolutional Layers of 128 channel 3x3 kernel and same padding, 6 Convolutional Layers of 512 channel 3x3 kernel and samepadding, 3 Convolutional Layers of 256 channel 3x3 kernel and same padding and 64 channel 3x3 kernel and same padding. Each layer now has a Rectified Linear Unit activation function.

3) Pooling Step:

One of the most crucial steps in the Convolutional neural network is this step. In Convolutional Neural Network, it is down sampling approach that is used. The primary goal of implementing pooling is to lower the image's spatial size. Min pooling, Average pooling and Max pooling are the three types of pooling. We used the maximum pooling strategy in our mode.

4) Full Connection Step:

To convert a matrix to a one-dimensional vector, a completely linked layer is needed. Our network's pooling layer creates a matrix as an output, which serves as an input for the fully connected layer. The dense() layer performs linear operations after converting a matrix into a long vector using the flatten() method. The activation functions are Relu() and Softmax.1 Dense layer of 4096 units, and 1 dense layer softmax layer of 4 units are the dense layers. Both the dense layer of 4097 units and the relu function have been utilized to prevent negative values from being passed across the network. We used a two-unit dense layer with softmax.

5. EXPERIMENTAL ANALYSIS RESEARCH

The model accurately predicts which disease the rice plant would be infected from after being tested with the testing data. Using the transfer learning method, we were able to obtain a 98 percent accuracy rate as shown in Fig 3. Transfer learning is an effective method for solving complex deep learning problems, particularly. image-based challenges. When we have a complex challenge to address, this set of architectures might be quite useful.

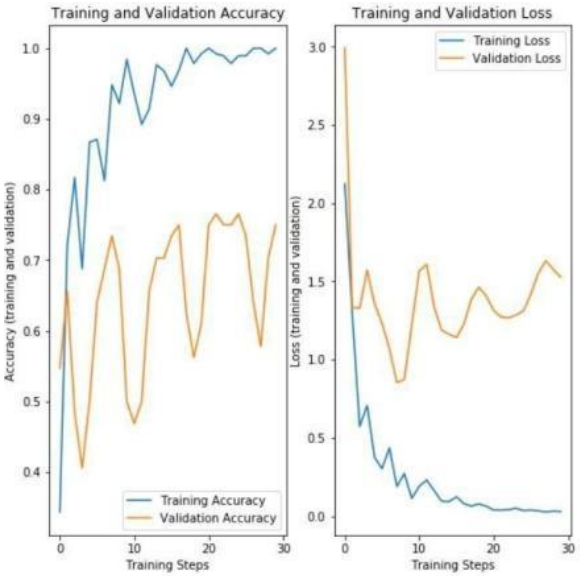

Fig 3:Graph Representation for Epoch vs Accuracy

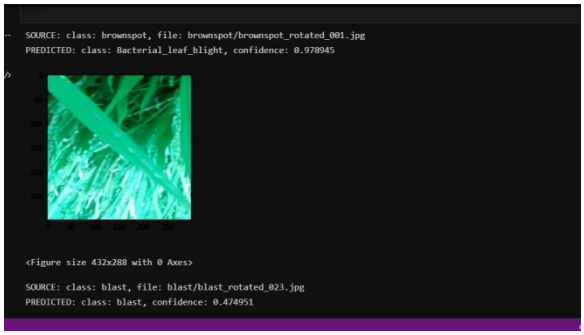

Fig 4: Brown spot Disease

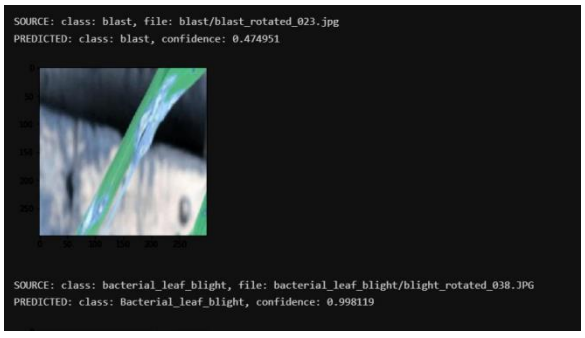

Fig 5: Blast Disease

Fig 6: Blight Disease

6. CONCLUSION

In the agricultural arena, a lack of technical skills and understanding can lead to serious problems with plant Health. In recent years, the IT industry's extensive participation in the world of agriculture has altered the process of detecting and diagnosing several dangerous diseases. This model employs transfer learning, a technique for efficiently and elegantly tackling complicated image processing issues. It takes the characteristic from the leaves and predicts the ailment that theplant is afflicted with. This model rigorously adheres to the classification and detection concept. This model's potential and future are quite promising. The farmer or individual will post a well- photographed image

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