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Paddy Crop Disease Detection Using Deep Learning

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ABSTRACT:

Due to a number of circumstances, crop diseases are one of the major problems affecting farmers today's loss in agricultural output. There are various types of crop diseases like Bacterial Leaf Streak, Bacterial Panicle Blight, Blast etc., which are affecting the Paddy crop. The toughest task for the farmers is to identify the type of disease that has been affecting. To treat the paddy diseased crop, farmers must know which type of disease has been affecting the crop but the farmers don't have any idea about the type of disease or which type of pesticides or insecticides that are to be used for reducing the disease. So, we proposed model that uses Deep Learning technique ie., Convolutional Neural Networks (CNNs) for paddy crop disease detection. The proposed approach can be used as a useful tool for farmers and agricultural researchers to detect and diagnose paddy crop diseases early and accurately.

Key Word*–Deep Learning Model, Convolutional Neural Network(CNN), Training Model, Disease Detection, Bacterial Leaf Blight, Bacterial Leaf Streak, Bacterial Panicle Blight, Blast, Brown Spot, Dead Heart, Downy Mildew, Hispa, Tungro.*

INTRODUCTION

Overview

The project's primary goal is to detect the diseases affecting paddy crops using pictures of the crop and to offer the appropriate treatments using the CNN algorithm and Transfer Learning algorithm.

Scope of the Project

The main contributions of this project therefore are

- Dataset collection
- Data preprocessing
- Model selection and training
- Model evaluation
- Deployment

The project's primary goal is to identify paddy field diseases using images of the crop and to offer the appropriate treatments using CNN and Transfer Learning. The primary problem is that farmers lack the appropriate disease identification skills and knowledge of effective preventive measures for disease control. A variety of corrective actions, such as different To prevent crop diseases and increase crop output, pesticides and insecticides are available. However, identifying the current illness and providing the best treatments are necessary in order to reduce the disease. Such time and money are required for this. The leaves reflect the existence of a disease on the plant, which exhibit certain disease-related symptoms. These particular symptoms serve as a feature to identify the particular illness. With the help of these characteristics, we created a machine learning model which diagnoses paddy crop diseases and advising the best treatments, like insecticides or pesticides, to control the illness, a machine learning model is a cutting-edge technology that is less expensive and delivers accurate results in a shorter amount of time.

RELATED WORKS

In this article, Chowdary Rafeed Rahman, Prectom Saha Arko, and Mohammed Eunus Ali provide a model that suggests cutting-edge large-scale architectures like VGG16 and InceptionV3 are used for identifying infectious illnesses and pests. The usefulness of these models with real datasets is demonstrated by experimental findings. [1]

In this paper, Bari BS, Islam MN, Rashid M, Hasan MJ, Razman MAM, Musa RM, Ab Nasir AF, and P P Abdul Majeed A. proposed a model that provides a machine-driven disease diagnosis systems. It uses conventional methods like Faster R-CNN method and RPN architecture which diagnoses leaf disease. [2]

The authors of this research, Mrs. Shruti U, Dr. Nagaveni V, and Dr. Raghavendra B K, provided a model that outlines the steps of a system for detecting general plant illnesses as well as a comparison of machine learning classification algorithms for this purpose. In this study, it was found that convolutional neural networks provide good accuracy and can identify a greater variety of agricultural illnesses.[3]

In this study, Harshadkumar B. Prajapati, Jitesh P. Shah, and Vipul K. Dabhi established a prototype system for detecting and classifying the sickness of rice using photographs of diseased rice plants. This prototype system was created following a thorough experimental investigation of the various image processing approaches. [4]

The authors of this study, Bashir, K., Rehman, M., and Bari, M., suggested a model that is designed using SVM (Support Vector Machine)-based image-processing approach which can able to classify three diseased rice crop diseases. The process comprises of two steps, they are training and disease prediction phase. With the aid of a trained classifier, the method detects illness on leaves. This model's work maximises the effectiveness of the SVM's gamma and nu parameters.[5]

In this research, Q. Yao, Z. Guan, Y. Zhou, J. Tang, Y. Hu, and B. Yang introduced a model that applies image processing techniques and Support Vector Machine (SVM) in order to detect rice diseases early and reliably. The shape and textural characteristics of rice disease spots were retrieved after segmentation. Rice leaf blight caused by bacteria, rice sheath blight, and rice blast were all classified in this model using the SVM approach. [6]

PROPOSED SYSTEM

In the proposed method has focused on identifying paddy diseases and offering the appropriate treatments, which increases paddy crop production**.** With this method, rice diseases like rice blast and bacterial leaf blight and some other diseases are detected and treated with pesticides or insecticides to prevent further spread. The transfer learning algorithm can identify the sort of paddy disease. The data collection is first loaded and pre-processed to reduce its size and convert it to greyscale. Next, using the transfer learning algorithm, the features are extracted, and these attributes will make training the model easier. After training, the model can detect the illness.

ADVANTAGES

- Accuracy was good
- Training time is fast
- Better prediction results

SYSTEM ARCHITECTURE

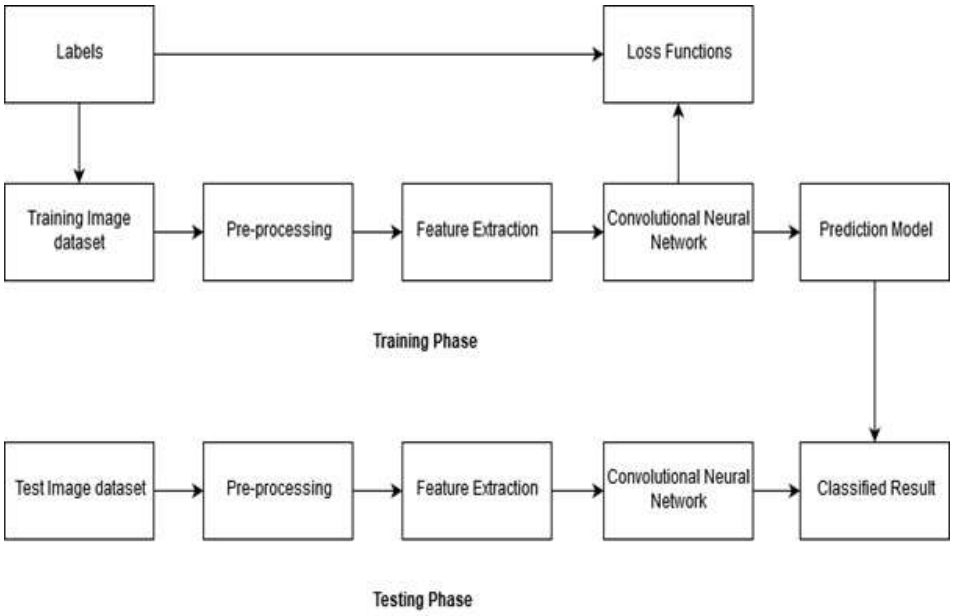

Fig. System Architecture

SYSTEM REQUIREMENTS

Hardware System Configuration: -

Processor : I3/Intel Processor

RAM : 4GB (min)

Hard Disk : 160GB

Key Board : Standard Windows Keyboard

Mouse : Two or Three Button Mouse

Monitor : SVGA

Software System Configuration: -

Operating System : Windows 10

Language : Python

Framework : Deep Learning

Server side Script : Google Colab

IDE : Jupyter note book

Algorithms : CNN, Transfer Learning

MODULES

Data Preprocessing

Any type of refining done on raw data to get it ready for another data refining method is referred to as data preprocessing, which is a part of data preparation. It has historically been a crucial first step in the data mining procedure.

Data Augmentation

A method called image data augmentation turns existing images into new ones. You can achieve this by making a few minor adjustments to them, such as changing the image's brightness, rotating it, or moving the subject laterally or vertically. Using image augmentation methods, you can artificially expand the size of your training set and give your model much more data to work with. By making your model better able to identify novel variations of your training data, you can increase the accuracy of your model.

Models:

There are two modules used for this project. They are

- CNN(Convolutional Neural Network)
- Transfer Learning

CNN(Convolutional Neural Network)

Machine learning includes convolutional neural networks, also known as convnets (CNNs). It is a subset of the numerous artificial neural network models that are employed for various applications and data sets. For deep learning algorithms, a CNN is a specific kind of network architecture that is used for tasks like image recognition and pixel data processing. Although there are other kinds of neural networks in deep learning, CNNs are the mainly used network design for identifying and recognizing objects. They are therefore ideally suited for computer vision (CV) jobs and for applications where accurate object recognition is crucial, like facial and self-driving car systems.

CNN layers

In-depth research The three layers that make up CNN are a convolutional layer, a pooling layer, and a fully connected (FC) layer. Convolutional layer is the first layer, and FC layer is the last layer.

Convolutional layer

The convolutional layer, the central component of a CNN, is where most calculations take place. The first convolutional layer may be followed by a subsequent convolutional layer. A kernel or filter inside this layer moves across the image's receptive fields during the convolution procedure to determine whether a feature is present. The kernel traverses the complete image over a number of iterations. A dot product between the input pixels and the filter is

computed at the end of each iteration. A feature map or convolved feature is the result of the spots being connected in a particular pattern. In this layer, the image is ultimately transformed into numerical values that the CNN can understand and extract pertinent patterns from.

Pooling layer

The pooling layer similarly to the convolutional layer sweeps a kernel or filter across the input picture. Contrary to the convolutional layer, the pooling layer has fewer input factors but also causes some information to be lost. Positively, this layer simplifies the CNN and increases its effectiveness.

Fully connected layer

Pictures are classified based on the traits that were derived from the earlier layers in the CNN takes place in the FC layer. Fully connected in this context indicates that every activation unit or node of the subsequent layer is connected to every input or node from the preceding layer. The CNN does not have all of its layers completely connected because that would create an excessively dense network. It would cost a lot to compute, raise losses, and have an impact on output quality.

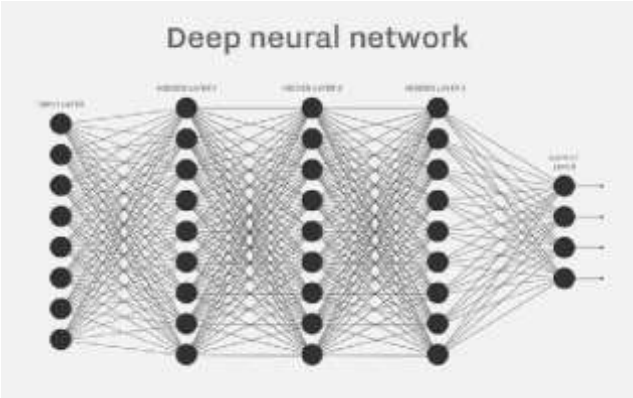

Fig. Structure of deep neural network

DATA FLOW DIAGRAM

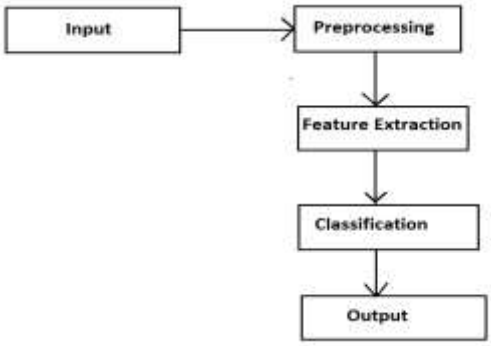

Fig. Data Flow Diagram

SCREENSHOTS

Fig. Home page of the Proposed model

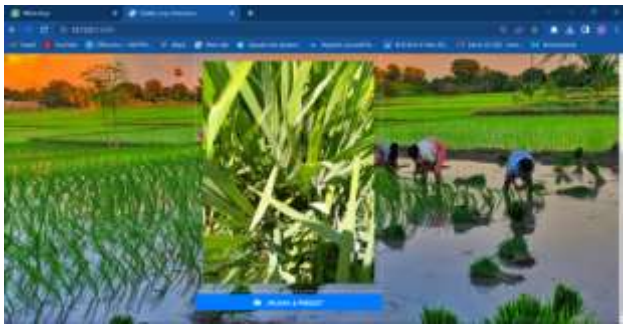

Fig. Uploading page of the Proposed model

Fig. Paddy crop disease prediction

CONCLUSION

Farmers are having trouble identifying diseases in paddy crops and are unable to locate pesticides or insecticides that work well to control the infected diseasesBy developing a machine learning model that uses the Convolutional Neural Network (CNN) algorithm and the Transfer Learning algorithm to identify the various diseases and healthy paddy leaf images, the problem of controlling the many types of rice diseases can be solved by employing insecticides or pesticides we are able to resolve the aforementioned problem. As compared to the current technique, the system is more reliable, user-friendly, quick, and cost-effective.

FUTURE ENHANCEMENT

Future research should focus on using deep learning to identify diseases in paddy crops. Deep learning algorithms are well adapted for identifying diseases in crops because they can learn intricate patterns and relationships from huge datasets. Here are some potential future advancements in this field, including increased precision, quicker detection, and technology integration. Overall, deep learning-based paddy crop disease detection holds great promise for the future and could assist farmers in increasing agricultural yields and lowering disease-related losses.

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