DETECTION OF COTTON PLANT DISEASE USING DEEP LEARNING

Abstract: Agriculture is essential to the growth of every country. Cotton and other significant crops are referred to as "cash crops". Cotton is affected by the majority of diseases that seriously damage crops. Many diseases affect yield by way of the leaf. Early disease identification guards against further damage to crops. Cotton can be affected by a variety of diseases, including leaf spot, target spot, bacterial blight, nutrient deficiency, powdery mildew, leaf curl, etc. For appropriate action to be taken, illness detection must be done accurately. Deep learning is crucial for correctly diagnosing plant diseases. The suggested model built on meta–Deep Learning is utilised to precisely identify various illnesses of cotton leaves. ResNet50, ResNet152V2, and our proposed model—the meta deep learn leaf disease diagnosis model—were trained on the dataset together with Inception V3 Transfer Learning. In order to offer excellent accuracy and generalisation, a meta learning approach has been suggested and put into practise. With a 98.53% accuracy rate, the proposed model has done better than the Cotton Dataset.

Keywords: Deep learning, Cotton plant disease, ResNet152V2, Dataset.

1. Introduction

In this study, we demonstrate how to identify diseases in cotton plants utilising automated vision systems for agricultural fields. The study of automatic plant disease detection is crucial to agriculture since it allows for the automatic identification of disease signs as soon as they occur on plant leaves while monitoring vast fields of crops. It is exceedingly challenging for a farmer to recognise different plant diseases. $60 billion is the projected yearly crop loss globally as a result of plant disease. Traditional methods and instruments are not very effective since they require a lot of physical labour and time.

An anomaly in physiology is a plant disease. Each illness that affects plants causes distinct symptoms. The physical changes to the eyes' external appearance are symptoms. Wilted leaf patches, rots, cankers, and many other conditions serve as examples of symptoms. This model's primary objective is to identify a cotton plant's ailment and offer a treatment. Based on a spot on the leaves, the Transfer Learning model is utilised to determine whether or not the plant is ill. The notion of ensemble learning is used in the suggested study effort and is applied using a deep learning algorithm. The model with the best accuracy is chosen after comparison of the results.

This project's objective is to develop a system that farmers may use to get information about the condition and possible treatments by sending photographs to a centralised expert system. The farmers will receive diagnostic technologies in this way from human experts. To guarantee that the disease can be recognised in enough quantities on photos, the computer scientist will utilise this information to generate a training set that will be applied to the images. The pattern matching algorithm will be created in order to quickly and accurately identify the illness in its earliest stages. The practise of detecting illnesses by examining their physical characteristics is known as cotton leaf disease diagnosis.

2. Literature Survey

An assertion regarding what one anticipates will happen in the future is known as a prediction. Every day, many predictions are made. While some are very serious and based on mathematics, others are only guesses. Predicting what will happen in the future, whether it be in a few months, a year, or ten years, can help us in a number of ways. The purpose of "Detection of Cotton Plant Disease with Deep Learning" is to study and analyse the use of deep learning to enhance and detect cotton plant disease. This project uses an image processing technique for an automated vision system to scan an image of a leaf and determine whether the cotton plant is healthy or infected with a disease. It then offers advice to the framer about how to recognise whether the plant is sick and even how to treat that disease.

3. Proposed Model:

The Process of detecting the cotton plant disease is shown in Fig: 1. Each and every phase has different step shown in fig.

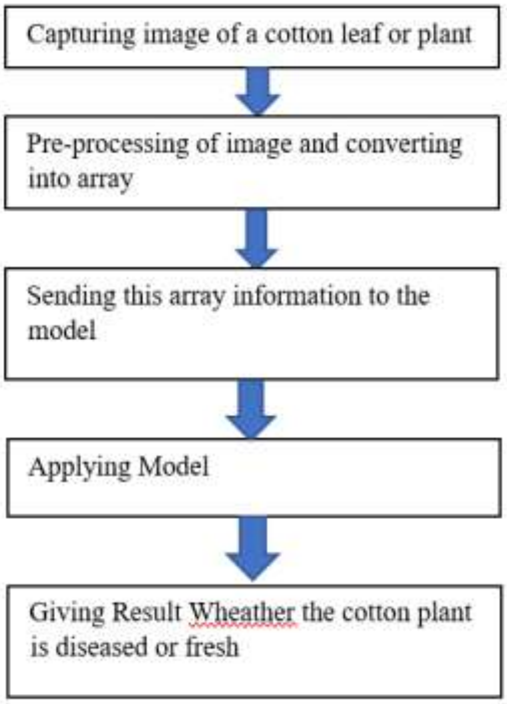

Fig:1 An Overview of Proposed Methodology

Based upon the fig:1 whenever the any cotton plant image is received it will check with the training dataset and predict whether the cotton plant is diseased or not, after that it will give suggestions to the farmer, if the predicted result is diseased cotton plant or leaf. The suggestions are all about the symptoms and the management of the disease occurred to the cotton plant i.e. The farmer can save his crop from the diseases which will save the time of farmer and man power and also saves the farmer from huge amount of loss.

4. Data set and Image Pre-Processing Description:

4.1 Data Set: From this detection of cotton plant disease, The dataset that we use for the detection of cotton plant disease was taken from the Kaggle repository which contain 2394 images out of which 346 images belong to diseased cotton leaf, 1022 images belong to diseased cotton plant, 512 images belong to fresh cotton leaf, 514 images belong to fresh cotton plant . All the images are of jpg format.

Fig: 2 Datasets containing Images of diseased cotton leaf

Fig.3 Datasets containing images of fresh cotton plant

4.2 Image Pre-processing:

Image pre-processing is a critical step in computer vision and image processing applications that involves applying various techniques to raw images to enhance their quality and prepare them for analysis or further processing. Some common techniques used in image pre-processing include: Image resizing and cropping, Image normalization, Noise reduction, Image enhancement, Colour conversion, Edge detection. Image pre-processing include resizing of image into the required size and also rescaling of image by using image data generator which is a pre-processing technique imported from karas.

5. **Technology Used:**

The technology used to develop this project is Deep Learning.

5.1: **Deep Learning:**

Deep Learning is part of the artificial intelligence and computer sciences which focuses about using data and algorithms to model the way that humans learn and increase the accuracy of the system. Deep learning has been divided into different categories based upon the problems. Deep learning has various techniques:

A. Transfer learning:

Transfer learning is a machine learning technique that involves taking a pre-trained model and adapting it to a new task or domain. In transfer learning, the knowledge learned by a model in solving one problem is leveraged to solve a different but related problem.

The idea behind transfer learning is that the knowledge learned by a model on one task can be applied to another task,

5.2 Algorithms used for Prediction:

A. ResNet152V2:

Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun proposed the ResNet152V2 convolutional neural network (CNN) architecture in 2016. It is an improvement on the first ResNet architecture, which was created to deal with the issue of disappearing gradients in very deep neural networks.

ResNet152V2 is one of the most intricate CNN designs to date since it has 152 layers and is a highly deep neural network. It is constructed utilising residual blocks, which enable the transmission of gradients over several layers and the reuse of learnt features. Moreover, ResNet152V2 makes use of bottleneck blocks, which lessen the amount of filters in the intermediary layers, hence lowering the computational cost of the network.

B. Inception V3:

The Inception V3 convolutional neural network (CNN) architecture in 2015. The original Inception architecture, which was created to solve the trade-off between depth and computing efficiency in neural networks, has been improved by this architecture.

The 48-layer deep neural network Inception V3 is built on the principle of factorising convolutions into smaller ones. By using this method, the model's accuracy is maintained while the number of parameters and computational expense are reduced. Also, the architecture has elements like batch normalisation and RMSprop optimization that enhance the efficiency and stability of training.

Resnet 50

The ResNet architecture was first developed by Kaiming He, Xiangyu Zhang, Shaoqing Ren, and Jian Sun in 2015. ResNet-50 is a variation of the ResNet design. At only 50 layers, it has less layers than deeper models like ResNet-50 or ResNet-152, making it quicker and simpler to train.

ResNet-50 employs residual blocks, like previous ResNet models, to enable the reuse of learnt features and the transmission of gradients over several layers. Nevertheless, compared to deeper ResNet models, ResNet-50 has a simpler bottleneck block architecture because of its smaller size.

6 Results:

Using our own Transfer learning with the "Soft Max" activation algorithm and two MaxPooling2D layers. After applying all of these layers, the model is flattened and a dense layer with the activation function "Soft Max" is applied as a completely linked layer. All of the photos that we use are 224*224 pixels in size. To ensure that all of the photographs have the same dimensions, we are converting the sizes using the OpenCV library. We use the Adam optimizer to build the model, and the accuracy is measured using metrics while the loss function is binary cross entropy.

Fig 4 : Home Screen

In the application's home page shown above, users have the opportunity to select an image from among many data sets and receive a prediction of the outcome and an explanation for it.

Fig 5 : Fresh Cotton Plant

Fig 6 : diseased cotton plant

Fig 7 : Fresh cotton leaf

Fig 8 : diseased cotton leaf

These are some output screens for the user to consider when analysing and gaining an understanding of various plant illnesses, as well as some recommendations for plant diseases.

7 Conclusion and Future Scope

Four different sorts of photos were utilised to identify diseases in cotton plants. Images of a healthy cotton plant, a healthy cotton leaf, a damaged cotton plant, and a diseased cotton plant In our research, we employed transfer learning techniques to identify illness and accurately forecast damaged leaves. We employed Inception V3, ResNet50, and RestNet152V2 as our three transfer learning algorithms for this model development. We have created three models by utilising these three methods. ResNet152V2 has provided the greatest accuracy out of all three, at 99.6%. in contrast to previous training models, we have developed. We intend to use 3D photos of cotton plants in the future to more effectively detect cotton diseases.

We wish to develop a dataset stressing the abstract with regard to our nation to speed the breadth of our work because working with a larger dataset will be more difficult in this regard.

The project may be expanded to include the categorization of many cotton illnesses, however additional training data points are required for more reliable findings. After making the site accessible to everyone, we may create the training set. The user-uploaded image for prediction at this step may be taken into account when creating the training set data, allowing us to train the system and improve outcomes.

8 References

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