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Metaphorical Analysis of diseases in Tomato leaves using Deep Learning Algorithms

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ABSTRACT

The objective is to use Deep Learning methods to identify and detect the tomato leaf disease. A pre-trained deep learning Convolutional Neural Network (Deep-CNN) model called ResNet-50 is part of the methods used in this study to identify tomato leaf disease. Images are classified using the Tensorflow image classification model. A deep-CNN based disease detection model for tomato leaves has been created using Keras taking all of these factors into account. The validation parameters learned by the ResNet-50 model are then used to process the testing data set.

Keywords: Leaf Disease Detection, Deep-CNN, ResNet-50, Tensorflow, Keras.

1. INTRODUCTION

Early detection of plant leaves is critical in a developing agricultural economy like India. Plant leaf diseases must be identified early on and preventative measures must be taken in order to make plants safe and stop losses to the agri-based economy. This is valid not only given that our economy is based on agriculture but also given the size of our population. employing deep learning techniques to find tomato plant leaf disease. In order to detect diseases in tomato leaves, the CNN, a type of deep neural network, is being deployed. The data set is first divided into three categories, including Early diseased, very Early diseased, and Healthy leaves, prior to the detection of tomato leaves. The transfer learning method is used to import a pre-trained model (ResNet-50) and modify it to match our categorization issue. The CNN pre-trained deep learning model for image categorization is called ResNet-50. Tensorflow image classification model is used to categorize images. Model-inception.h5 is used to perform the image recognition. In order to enhance the ResNet model performance and ensure the findings are as precise as possible, data augmentation has been used. All of these parameters have been taken into consideration when developing a deep-CNN based disease detection model for tomato leaves using Keras. For the implementation of neural networks, a high-level, deep learning Application Programming Interface (API) called Keras was created. It is used to make neural network implementation simple and is built in Python. In order to accelerate computational tasks, you can employ graphics processing units (GPUs), which are specialized processing cores. Originally intended for the processing of visual data like images, these cores. The testing data set is subsequently processed for validation using the learned parameters from the ResNet-50 model.

2. METHODOLOGY

Methods and Algorithms Employed

i. Deep Learning - Convolutional Neural Network (Deep -CNN)

Artificial neural networks like the Deep-CNN are frequently used for image/object recognition and classification. Thus, by utilizing a CNN, Deep Learning (DL) recognizes objects in an image. The principal applications of CNN, a neural network with one or more convolutional layers, include image processing, classification, segmentation, and other auto correlated data. In essence, a convolution involves swiping a filter over the input. In order for CNN to function, it must first obtain an image, weight it according to the various things in the image, and then separate one object from the others. Convolutional, pooling, and a fully connected layer are the three layers that make up this system. It is a subcategory of neural networks that handles data with a grid-like architecture. The foundational component of CNN that handles the majority of computation is the convolution layer. For working with images and videos, CNN is specifically created. It receives photos as inputs, extracts and learns the features of the images, and then categorizes the inputs using the learned features.

Procedures used to use CNN to find Tomato leaf disease

Step 1: Select a Dataset.

Step 2: Prepare the Dataset for Training.

Step 3: Produce Training Data.

Step 4: Rearrange the dataset.

Step 5: Assigning Labels and Features.

Step 6: Take images as inputs for the process.

Step 7: Extracts and learns the image features.

Step 8: Classify them in accordance with the discovered features.

Step 9: Gather data and train the CNN model.

Step 10: Model Accuracy and Score.

ii. ResNet-50

A residual neural network (ResNet) is an artificial neural network (ANN). The ResNet-50 is a pre-trained deep learning model for image classification of the CNN. It is a gateless or open-gated variation of the HighwayNet, which was the first functionally complete, extremely deep feedforward neural network with hundreds of layers—much deeper than earlier neural networks. A CNN with 50 layers is called ResNet-50. The ImageNet database contains a pretrained version of the network that has been trained on more than a million images. There are 5 stages in the ResNet-50 model, each with a convolution and an identity block. Each identity block and each convolution block each have three convolution layers. There are around 23 million trainable parameters in the ResNet-50.

Use ResNet 50 with Keras

Step 1: To begin, need to execute a programme to specify the identity blocks in order to convert the CNN into a residual network and create the convolution block.

Step 2: After integrating the two blocks, the 50-layer Resnet model is built.

Step 3: Last but not least, you must train the model to perform the necessary task. You can quickly and simply create a thorough description of the network architecture you created with Keras.

iii. Keras

An Application Programming Interface (API) for deep learning called Keras is developed to implement neural networks at a high level. It is made to simplify the implementation of neural networks and is written in Python. It will construct a basic CNN and train it to use Keras to resolve a real-world issue. For distributed deep learning model training, Keras is utilized. Using TensorFlow as its foundation, Keras is a high-level neural network Python framework. In order to implement deep learning models for research and development as quickly and simply as feasible, this tool was created.

Steps for execution of Keras

Step 1: Create a model

A new instance of a model object is initially created by Keras, and then successive layers are added to it. The API is known as a sequential model. By calling model, we can simply add layers to the neural network. adding the kind of layer we wish to add while handing it in.

Step 2: Train the model

The model can be trained by calling model. fit and pass using the practise data and the desired result.

Step 3: Test the model

Calling model allows us to test the model.evaluate and pass the testing data set and the desired result.

Step 4: Save and Load the model

When we get the best outcomes, we can use model to store the model. save the file, then enter its name. Everything we need to use our model in another software will be in this file.

iv. Tensorflow

In computer vision, CNNs are mostly used for object recognition and image classification. Google developed and released TensorFlow, a Python library for quick numerical computations. It is a foundation library that may be used to build Deep Learning models directly or indirectly using wrapper libraries created on top of TensorFlow to make the process easier. You may design extremely adaptable CNN networks for computer vision problems using the open source TensorFlow framework. A free and open-source software library for artificial intelligence and machine learning is called TensorFlow. Although it can be applied to many different tasks, deep neural network training and inference are given special attention. The tensorflow in python is imported using pip install tensorflow.

v. model-inception.h5

Inception Module

An image model block called an Inception Module seeks to simulate an ideal local sparse structure in a CNN. Simply said, it enables us to combine several filter sizes into a single image block rather than being limited to a single filter size, which we then pass onto the following layer.

H5 is a file format for structured data storage; it is not a model in and of itself. Models are saved in this format by Keras because it is simple to combine model settings and weights into a single file.

vi. transfer learning inception v3

A pre-trained neural network is used in the machine learning technique of transfer learning. For instance, the two components of the image recognition model Inception-v3 are as follows: using a convolutional neural network for the feature extraction portion. Fully linked and softmax layers in the classification section.

3. RESULT AND DISCUSSION

For the purpose of identifying diseases in tomato leaves, the data set is initially split into three types, such as Early diseased, very Early diseased, and Healthy leaves.

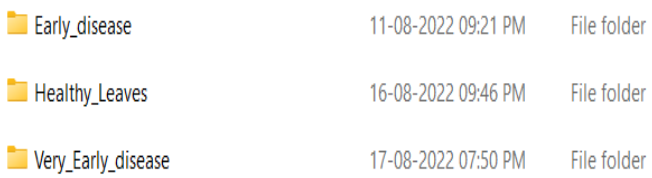

Fig 1: Tomato leaf data set.

A pre-trained model (ResNet-50) is imported and altered using the transfer learning technique to address our categorization problem. ResNet-50 is a CNN pre-trained deep learning network for categorizing images. Images are classified using the Tensorflow image classification model. A deep-CNN based disease detection model for tomato leaves has been created using Keras taking all of these factors into account. For implementing neural networks, a high-level, deep learning API named Keras was developed. It was created in Python and is used to simplify the implementation of neural networks. The validation data set is then processed with the learned parameters of the ResNet-50 model.

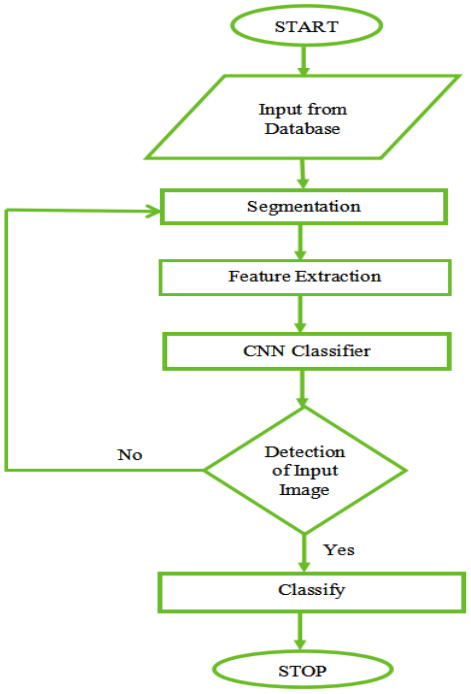

Fig 2: Flowchart of Tomato leaf disease detection.

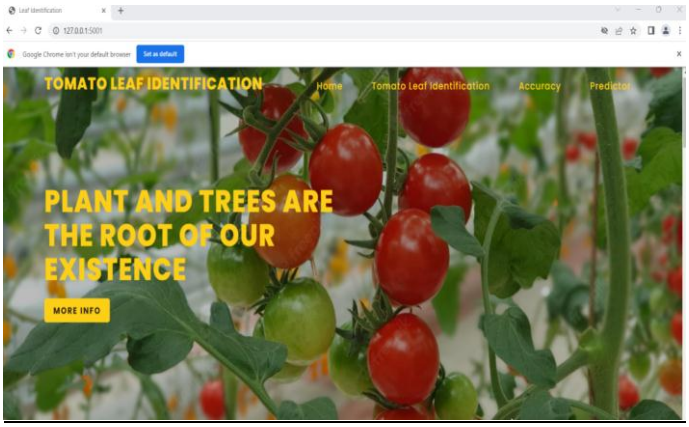

Fig 3: Tomato Leaf Disease Detection Window.

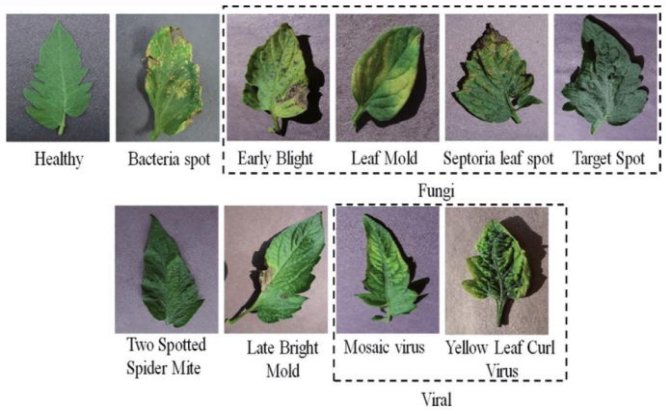

Fig 4: Samples of the datasets.

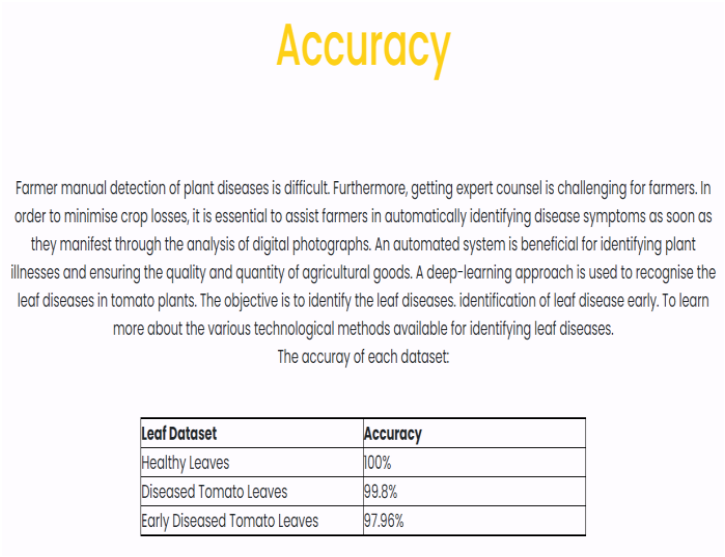

Fig 5: Tomato Leaf Disease Detection Accuracy Window.

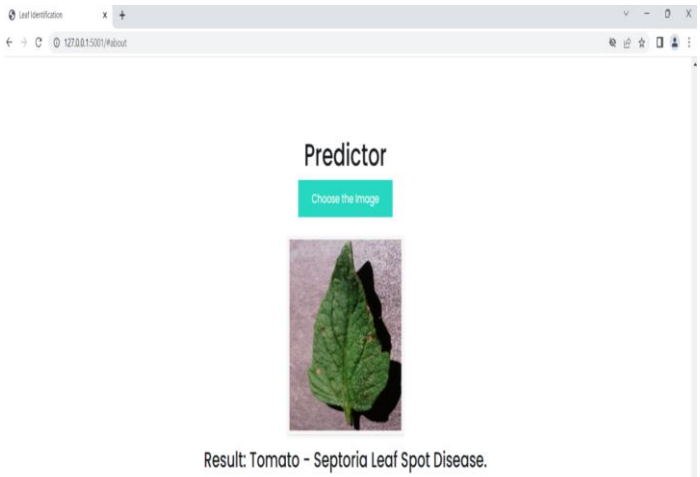

Fig 6: Tomato Leaf Disease Detection Output Screen.

4. CONCLUSION

The "Metaphorical Analysis of diseases in Tomato leaves using Deep Learning algorithms" project has been built and tested successfully. The manual diagnosis of plant diseases by farmers is challenging. Furthermore, it is difficult for farmers to access professional advice. In order to identify plant diseases, it is advantageous to have an automated system. To identify the leaf diseases in tomato plants, a deep-learning approach was applied.

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