TOMATO PLANT DISEASE DETECTION

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Abstract

Identification of plant diseases plays the key role in preventing the losses in the yield and quality of the agricultural product. The studies of plant diseases implies to studies of visually observable patterns perceived on the plant. Health monitoring and disease detection on the plant is very crucial for sustainable farming. It is a complicated task to monitor plant diseases manually. It requires a tremendous amount of work, expertise in plant diseases, and also require excessive processing time. Image processing makes it easier in detecting of plant diseases by capturing the images of the leaves and comparing them with the data sets. The data set consists has different plants in the image format. We made use of Convolutional Neural Networks for accurate results. After the detection of the disease, it suggests the fertilizers that can aid as being the cure for disease.

Keywords: Plant disease detection, NumPy, TensorFlow, Keras, OpenCV, Convolution Neural Network, Computer Vision

I Introduction

Trees and Plants are a boon to the mankind. There are approximately 380,000 plant species in the world. Out of these plant species only 150 species are cultivated and edible. We need to protect these plants for our survival. These plants are cultivated by the farmers for generations. Agriculture is the largest employment in the world and our country is the 2nd largest producer of agriculture product. With the growing population there is a necessity to increase the food production. By the year 2050, the requirement for food increases to 70% of what we are producing today. Though Agriculture is the largest employment it has numerous impediments to it. Traditional methods of farming are no longer feasible to provide the required amount of food. So, people started using modern methods of farming. With the advancement in technology and research assisting the farmers in cultivation we are able to increase the yield. Protecting the plants not only helps us to increase the productivity. The main objective is to detect the plant leaf diseases using real-time video and image capturing. This work aims at identifying the type of disease and suggesting the right fertilizers, insecticides and pesticides. These diseases can be identified using computer vision and machine learning techniques. The computer vision has seen tremendous amount of development over the years. It helps us to identify and classify the diseases easily. In the present day most people have access to a smartphone.

These smartphones can be used to capture the images of the infected leaves. They are also equipped with high computational power that can help in identifying the disease. With the help of the widespread technology, we can help farmers protect their crops against various diseases [9].

II Design

The main objective of this work is to detect the plant leaf disease using images of the affected leaves. This work uses OpenCV and CNN to detect the plant diseases form the real time images captured by using a smartphone or camera. The images are then processed in the browser to match with the pre-trained dataset. The design is divided into 4 modules [5]. Fig.1 represents a flowchart of the entire idea of the work which displays a step-by-step implementation of the work.

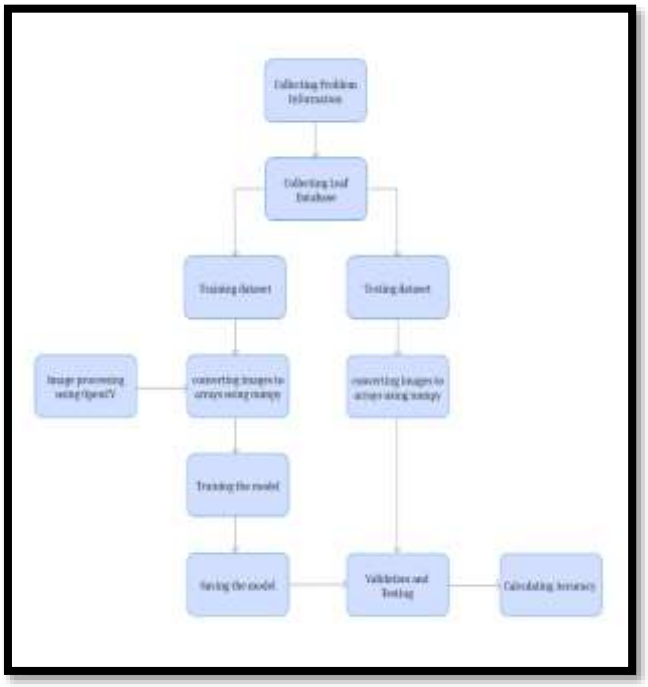

Fig.1: Tomato Plant Disease Detection

A. Dataset Creation

The first step of the process is to create a dataset. The dataset is then used to the match images with the real time images. The system is trained with more than 5000 images of various plant disease images. Each disease of the plant is given a separate folder with its specified name. These images are collected from various sources [3].

B. Training

The second step is to train the system with the created dataset. In this phase we converted the images in the training dataset to greyscale using OpenCV which is basically a image with black and white pixels. A model is built using these images which is trained using CNN which is a deep learning algorithm that analyzes visual imagery. The algorithm detects critical points which normal machine learning algorithms does not detect which makes the model more effective than regular model [8].

C. Disease Detection

Detecting the disease is the next step in the process. In the step a live image of the plant is captured and is uploaded to the system. The image is then compared with the existing trained data. Based on its match with the dataset the disease is detected [10].

D. Remedial Suggestion

After matching the images with the trained dataset and detecting the disease the system opens a new page where it displays the information about the disease and also suggests counter measures to restrict the spread of disease. The information about the plant diseases is collected from different sources. The information is static and is stored in the system. By following the methods prescribed by the system the farmer can eradicate the disease and protect the crops [4].

III. Implementation

This idea is implemented by using OpenCV, NumPy [6].CNN is used to train the model. The implementation steps are explained below

A. Dataset creation

The model is implemented by creating the dataset of the plant disease images. Various images of the infected plant leaves are collected. They are classified into respective diseases.

B. Training the model

The image is first converted into a greyscale image in which all the pixels in the image is turned into black and white. After that these images are converted into arrays using NumPy. These arrays are then passed through the CNN algorithm which uses TensorFlow and OpenCV. The output of the phase is a model which can detect the disease [1].

C. Disease Detection

After the model is created in the training phase the model is used to identify the disease. When we run the application, we get redirected to a server in which we need to upload the image of the effected leaf, then the model compares the uploaded image with the existing data and detects the disease and shows us the information of that particular disease [7].

D. Results.

This work is a web-based application. The UI is simple and easy to use. The images of this work are shown below. Fig 2 describes The Homepage of the work where the user can upload the image of the Tomato plant leaf and Fig.3 shows the page after identifying the disease based on the uploads image

Fig. 2: The Homepage of the work where the user can upload the image of the Tomato plant leaf

Fig.3: After identifying the disease based on the uploads image

IV. Conclusions and Future work

There are numerous ways by which we can detect diseases of plants and suggest remedies for them. Each has some pros as well as cons. The visual analysis method is the least expensive and simple method, it is not as efficient and reliable. Image processing is a technique which is highly spoken for being precise and least time consumption are major advantages offered. The applications of K-means clustering and Neural Networks (NNs) have been formulated for clustering and classification of diseases that cause effect on plant leaves. Identifying the disease accurately and efficiently is the main purpose of the proposed approach. The experimental results indicate that the proposed approach is a valuable approach, which can significantly support an accurate detection of leaf diseases in a little computational effort. Alongside the supply of cultivation tools, the farmers also need access to accurate information that they can use for efficient crop management and there is no better way than providing them a service that they can use through the software

This work can be integrated with IoT devices and can be installed in the fields to capture live images. That way the disease can be identified in the initial stages which will help in reducing the spread of the disease

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