Leaf Disease Detection and Prevention using Machine Learning

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Abstract

Plant illnesses are often brought on by pests, insects, and pathogens, and if they are not promptly handled, they significantly reduce yield. Farmers are losing money as a result of different crop diseases. When the cultivated area is enormous, measured in acres, the cultivators find it tiresome to routinely check on the crops. The suggested approach offers a way to automatically diagnose diseases using photos from remote sensing while also offering a solution for routinely monitoring the agricultural area. The suggested approach alerts the farmer about crop illnesses so they may take additional action. The suggested technology aims to identify infections early, as soon as they begin to spread to the leaf's outer layer. The two phases of the proposed system's operation start with training data sets. This involves using training sets with both healthy and sick data. The second stage involves crop monitoring and disease identification using Canny's edge detection technology.

Introduction

Farming gave rise to civilisation. India is a mostly agricultural nation with a crop-based economy. All economies are based on agriculture. A nation like India, where the population is growing and there is a constant need for food, has to make breakthroughs in the agricultural sector to

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fulfil this demand. To withstand the shifting economic circumstances in India, the agricultural industry requires a significant upgrade. Crop health is necessary for maximum yield, so a highly technological method is required for routine crop monitor. Crop disease is one of the main causes that has a substantial indirect impact on the quantity and quality of agricultural goods. To combat illnesses and boost output, a variety of insecticides are available. Nonetheless, finding the most up-to-date illness-appropriate and effective pesticide to control the infectious disease is challenging and requires specialist help, which takes time and is expensive. When a plant is sick, you may usually tell by looking at the leaves for symptoms.

Therefore, a machine vision system that can identify ailments from photographs and prescribe an appropriate pesticide as a cure is necessary. Such a system must be automated, accurate, and affordable. The majority of the people of India relies on agriculture, making it an agricultural nation. It's crucial to diagnose plant diseases in their early stages. Farmers need professionals to check them constantly, but doing so might be prohibitively costly and time-consuming. Therefore, it is very practical to search for a quick, less costly, and accurate way to identify illnesses from the symptoms that show up on the plant leaf. This makes it possible for machine vision, which will provide image-based autonomous detection. Discovering plant leaf disease is the goal of this effort. Machine-learning approaches for plant disease identification must prioritise accuracy and speed as their two key goals.

Techniques like automated plant disease detection and categorization employing leaf image processing methods need to be developed. Farmers will find this to be a valuable strategy that will warn them just in time to prevent the illness from spreading over a vast region. The solution is divided into four major steps. In the first phase, a colour transformation structure for an RGB leaf picture is created, and the colour transformation structure is then transformed into a different colour space. The picture is then divided. The second stage involves removing any excess leaf area (green area). For the segmented infected item, we compute the texture characteristics in the third step. The retrieved characteristics are finally run through a trained neural network in the fourth step.

Objective:

1. Identifying the crop diseases that affected them

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2. The treatment for the illnesses should also be provided.
3. Third, figuring out if the leaf is healthy or not requires a series of well planned steps. These steps include: data cleansing, feature extraction, classification, and classifier training. In the first stage of processing, the image sizes are normalised so that they are all the same.
4. To find the crop deaths, the system must apply the machine learning idea.
5. In order to get the information, the system must make use of image processing tools like RGB values.

Proposed System:

The first step of the proposed system, which comprises two parts, deals with training datasets. Images of both healthy and ailing leaves are gathered. The threshold is retrieved for both ageing and illnesses after the dataset is available with healthy and sick picture samples. Remote sensing is used to acquire photos on a regular basis. In order to determine whether a picture meets the threshold, its RGB values are compared to the ones from the monitored photographs. When the threshold is more than or less than the set value, histogram analysis and edge detection techniques are employed to identify specific plant diseases. In order to train the model, we feed it data on many different types of crops. For every crop, a large number of images are considered, both of perfect and imperfect crops. Establish a harvesting cutoff for each kind of crop. Instruct the model to make good judgments about what to do with each crop type.

ADVANTAGES OF PROPOSED SYSTEM:

1. The suggested method makes use of machine learning, which would improve the identification of agricultural diseases.
2. The procedure is speedier and more durable.
3. The suggested approach is economical.

Methodology:

A number of tests must be run to determine whether or not the leaf is healthy. They include preprocessing, feature extraction, classifying, and classifier training. One step in preprocessing is standardising the image size across the board. The next phase is using HOG to pull features out of a cleaned-up image. H-oG is a feature descriptor used for locating objects. Gradients in this feature descriptor characterise the appearance of the object and the outline of the image. One

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advantage is that H-oG feature extraction makes use of the freshly generated cells. It will not be affected by any modifications. In this example, we used the usage of three distinct feature descriptors. Hu images captured at at the right time that have all the necessary picture pixel qualities are invaluable for identifying and classifying objects. In this situation, Hu moments are helpful in identifying a certain leaf's form. Only on a single channel can Hu moments be calculated. Grayscale conversion of R-GB data is required prior to calculating Hu moments. In this phase, we provide a selection of shape characterizations. Hara-lick claims that you can tell the difference between a healthy leaf and a diseased one by the feel of it. The Hara-lick texture characteristic is used here to identify the differences between healthy and diseased leaves' textures. The position of every connected entity is stored in a matrix called the adjacency matrix (I,J). Texture is calculated based on how often pixel I is utilised to fill the area next to pixel J. In order to calculate the Haralick texture, the image must be grayscaled.

MODULES:

Preprocessing

Our model's whole structure is built on image processing and classification methods.

Using a digital camera, we collected environmental samples of several leaf kinds as digital picture samples.

Then, we used our suggested method to examine and modify each example picture.

Then, in order to further categorise those data for our necessary purpose, useful characteristics were retrieved.

Segmentation

As can be seen in figure 3, all of the leaf samples' RGB photos were first examined. The samples may be divided into flawless and flawed ones. We performed colour transformation in the second phase by writing a Matlab programme to convert digital images to binary images and subsequently to RGB images. The most crucial stage is image transformation since it provides the K-means clustering with its first input.

Clustering

The pixels of the sample leaf were divided into K number of clusters using comparable kinds of feature weights using the K-Means Clustering technique. This aids in locating the cluster comprising the area of the sample leaf that is affected with the particular illness.

Equalization of the histogram

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We have stretched out the range of accessible intensities using the histogram equalisation approach to improve the contrast in the sample data. The cumulative distribution function is used as a remapping function to transform the supplied sample distribution into a broader and more uniform distribution (cdf).

K-means Clustering

Each data point is repeatedly allocated to one of the K group base on the attributes that are retrieved in order to discover groupings in the unlabeled data with the figure of groups given by variable K. Data points are clustered depending on how similar their attributes are. A cluster's centroid defines a group of feature values.

Implementation

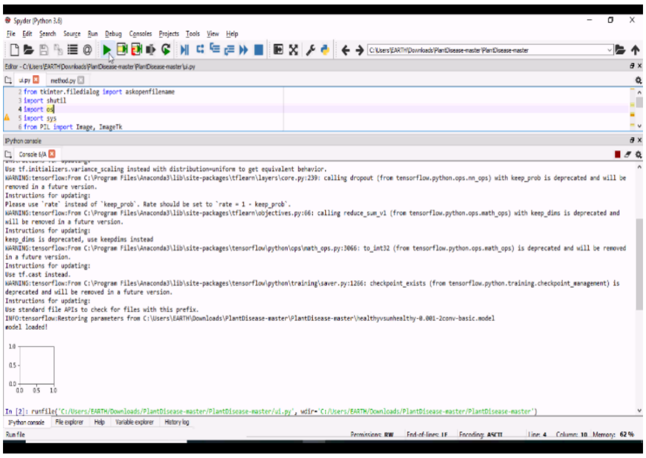
Software development refers to the phases of creating and maintaining software such as applications, frameworks, or other software components, including the phases of ideation, definition, design, programming, documentation, testing, and bug fixing.

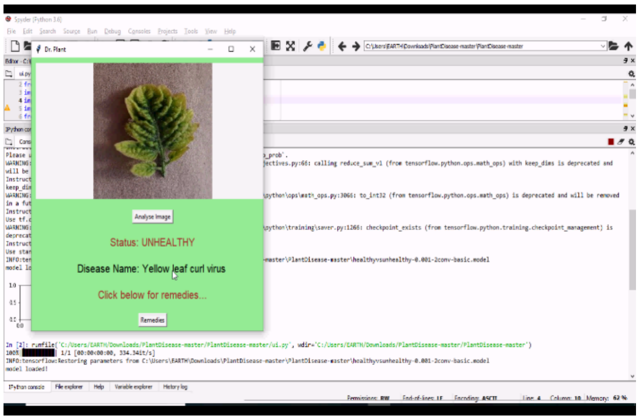
Programming: Python 3.6 and associated

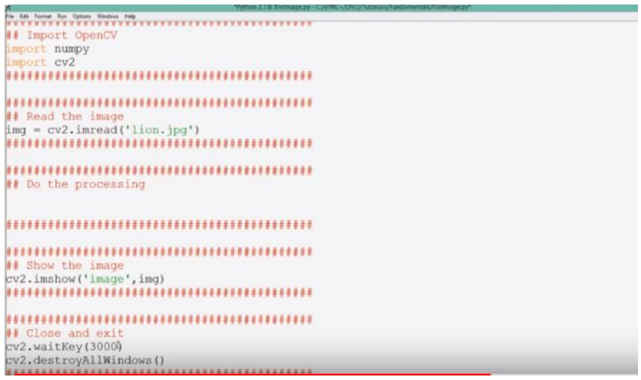
libraries; Operating System: Windows 7 or higher.

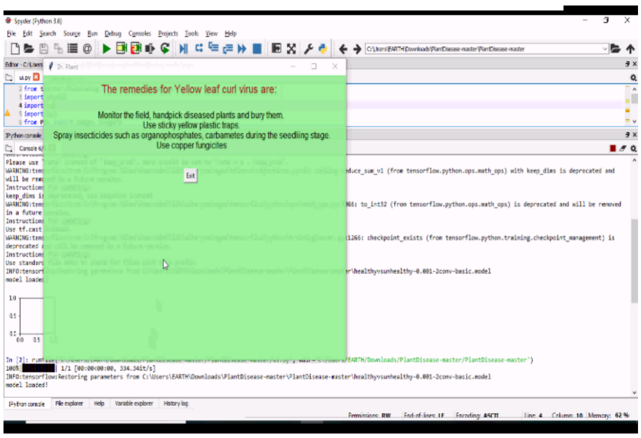
Technology used Python and Django

Results









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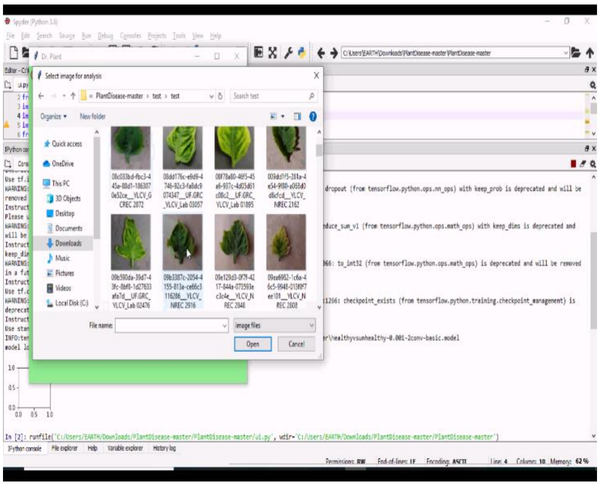

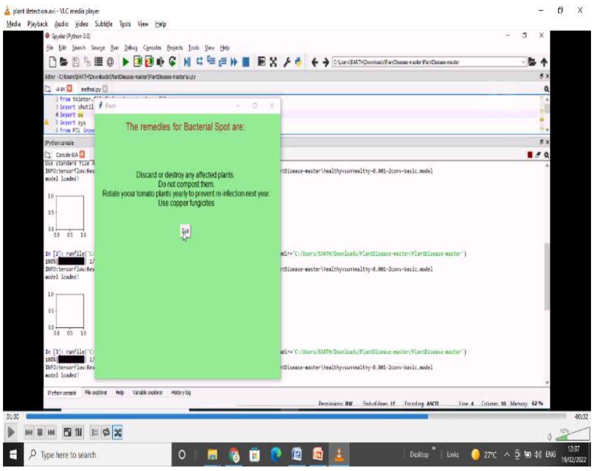

This article details the planning and development of an ML-based system that makes local, up-to-the-moment environmental data accessible and usable in rural agricultural fields.

Accurate environmental data is made available to academics and agricultural field managers in real time through push notifications to conveniently accessible cloud storage, eliminating the need for frequent trips to the crop field.

The average values of air temperature, relative humidity, and wind speed were predicted using a simple machine learning technique based on S-VM regression.

The illness may be detected early on using this technique, and the farmer can better estimate how much pesticides will be required for the crops.

This means less time and money spent on manufacturing.

Future Scope:

- Hybrid techniques such as Artificial Neural Networks, Bayes classifiers, and Fuzzy Logic may be employed to boost the recognition rate of the final classification and illness detection process.
- A simple and useful mobile app may be created.
- An next development of this study will automate a severity assessment of the diagnosed ailment.
- A potential future improvement of the project is the creation of open multimedia (audio/video) resources for learning about illnesses and their treatments once they have been diagnosed.

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