Identification of Agricultural Plant Leaf Disease using Image Processing- A Review

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Abstract: Plant diseases result in significant production and financial losses as well as a decline in the quantity and quality of agricultural goods. Plant disease identification is becoming more and more important in today's large-scale crop monitoring. Farmers find it very challenging to transition from one disease management method to another policy to a different one. The conventional method used in practice for identifying and detecting plant diseases is expert observation with the unaided eye. In order to support agricultural innovations, we evaluate the necessity for a basic plant leaf disease detection system in this paper. By using appropriate management techniques, early information on crop health and disease detection can help control illnesses. This method will increase agricultural productivity. Additionally, this essay contrasts the advantages and restrictions of these possible techniques. picture acquisition, picture pre-processing, feature extraction, and neural network-based categorization are some of the procedures involved.

Introduction: India is an agricultural nation where the majority of people make their living from farming. The goal of agricultural research is to increase food quality and productivity while lowering costs and increasing profit. Soil, seed, and agrochemicals interact intricately to create agricultural production systems. The most significant agricultural products are fruits and vegetables. Product quality management is essentially required to obtain more valuable items. Numerous studies indicate that plant diseases may lower the quality of agricultural goods. Diseases are disruptions to a plant's normal state that alter or stop essential processes including photosynthesis, transpiration, pollination, fertilization, germination, etc. These illnesses are brought on by pathogens, such as bacteria, viruses, and fungus, as well as unfavorable environmental factors. As a result, diagnosing plant diseases early on is crucial. Farmers need experts to monitor them constantly, which may be quite costly and time-consuming. Therefore, it is crucial to find a quick, affordable, and precise way to automatically identify illnesses from the symptoms that show up on plant leaves. This makes machine vision possible, which enables robot guiding, process control, and image-based automated inspection. This paper's focus is on using leaf texture to identify plant leaf diseases. Leaf offers a number of benefits. over fruits and flowers throughout the world's seasons.

Analysis of plant diseases and their signs

Agricultural science makes considerable use of RGB picture feature pixel counting algorithms. The following are some uses for image analysis:

1. To identify diseases of the fruit, stem, and leaves of plants.
2. To measure the disease-affected area.
3. To determine the impacted area's limits.
4. To ascertain the afflicted area's color
5. To ascertain fruit size and form.

The symptoms of bacterial, viral, and fungal plant leaf diseases are:

Bacterial disease symptoms:

The condition is characterized by little, pale green patches that quickly appear to be saturated in water. The lesions get bigger and eventually show up as dried dead patches. For example, bacterial leaf spots are water-soaked brown or black spots on the leaves that are usually the same size and occasionally have a yellow halo. The dots seem speckled when it's dried.

Viral disease symptoms:

Viral plant leaf diseases are the most challenging to diagnose. Since viruses don't exhibit any obvious symptoms, they are frequently mistaken for nutritional shortages and pesticide damage. Insects that frequently carry this disease include aphids, leafhoppers, whiteflies, and cucumber beetles. Illness, such as Mosaic Virus, Check the foliage for green or yellow patches or stripes. Growth may be slowed and leaves may wrinkle and curl.

(a) Bacterial leaf spot (b) mosaic virus

Figure 1. Bacterial and Viral disease on leaves

Fungal disease symptoms:

Among all plant leaf diseases, some of those brought on by fungi are covered below and illustrated in Figure 2, for example. Figure 2 (a) depicts late blight brought on by the fungus Phytophthora infesters. It initially shows up as water-soaked, gray-green patches on lower, older leaves. These patches darken and develop white fungal growth on the undersides as the fungal condition progresses. The fungus Alternaria solani, depicted in figure 2(b), is the cause of early blight. It initially manifests as tiny brown dots with concentric rings that create a bull's eye pattern on the lower, older leaves. As the illness progresses, it spreads across the leaf surface, turning it yellow. Within On the upper surfaces of older leaves, downy mildew appears as yellow to white blotches. As seen in figure 2(c), these regions have white to grayish undersides.

(a) late blight (b) early blight (c) downy mildew

Figure 2. Fungal disease on leaves

Literature review:

Girish L. [3] describes a machine learning approach for predicting crop productivity and rainfall. This study examines various machine learning techniques for the forecast rainfall and crop yield, as well as discuss the effectiveness of various machine learning algorithms, such as liner regression, SVM, KNN, and decision trees. They get to the conclusion that SVM has the best rainfall prediction efficiency in that method.

The many machine learning techniques used to increase crop productivity are described by Rahul Katarya [4]. This article examines various artificial intelligence approaches, including

big data analysis for precision agriculture and machine learning algorithms. Using KNN, ensemble-based models, neural networks, etc., they describe crop recommender systems.

In order to increase farmer profits and the standard of the agricultural industry, Ashwani Kumar Kushwaha [2] explains crop yield prediction techniques and suggests an appropriate crop. This work uses the Hadoop infrastructure and an agro algorithm to acquire massive amounts of data, referred to as "big data" (soil and meteorological data), for crop production prediction. Therefore, based on repository data, crop quality will be improved and the crop's compatibility for a given condition will be predicted.

For brain MRI segmentation, Huynh Van Lung and Jong-Myon Kim [13] created the generalized Spatial Fuzzy C-Means Clustering method (GSFCM). GSFCM makes use of spatial local information and specified pixel attributes that are equally weighted to neighbors according to their distance attributes. According to the results, GSFCM performs better than traditional FCM.

Proposed Methodology

I. Image Acquisition and Preprocessing:

The digital image is obtained from the place that refers to many websites. Whichever image capture technology is used, the image that has input is never adequate. The area of interest in the picture is obscured and interfered with by other items if there are disturbances. The preprocessing portion of the image includes three steps: clipping, smoothing, and enhancement. The process of gathering images and gathering a lot of data may introduce noise, which might easily result in the image's quality declining throughout operation and storage, which would impact the development of diseases.

II. Image Segmentation:

The image will be divided into various sections based on the location of interest. Image segmentation is the process of dividing an image into the same relevant region. K-medoids clustering is a partitioning technique based on the clustering approach for segmenting images. Every cluster is represented by the object in the cluster.

III. Extraction of features and statistical analysis:

The process of turning input data into a collection of features is known as feature extraction. The feature set should be properly selected because it will extract pertinent information. Co-occurrence approach is used to define shape through static sampling. This matrix measures the likelihood that a pixel at a specific gray level will occur at a different distance orientation from any given pixel.

IV. Classification based on classifier:

Neural networks are employed as a classification technique for the automatic detection of leaf disease. The two crucial phases for datasets for training and validation are the training feature set, which is used to train the NN mode, and the testing feature state, which uses the feed-forward back propagation network to confirm the correctness. They are constantly updated until the connection weight exceeds the specified iteration number. Therefore, the accuracy of the ANN model's response is guaranteed by employing the mean square error.

Conclusion:

Disease detection is a method that uses image processing techniques to identify the leaf spot affected area. The medium filter works better for noise from salt and pepper. The disease is reliably identified by CIELAB in the color model and is unaffected by background, leaf type, or distance. camera flash and spot. When it comes to grayscale images and huge databases, the K-medoids approach outperforms the K-means algorithm. The CIELAB color model, medium filter, and clustering and texture analysis are developed for disease classification and clustering. The suggested paper is a useful method that can greatly aid in the precise identification of leaf diseases with minimal computational effort.

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