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LEAF DISEASE DETECTION USING IMAGE PROCESSING

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Abstract: About 70% of the India economy depends on agriculture. Due to environmental changes such as rainfall, temperature, the crop yield gets affected severely. Phaseolus vulgaris L is an important food legume crops and provide essential diet for millions of people across the world. It is affected by various diseases out of which Anthracnose are of major importance. Anthracnose disease is caused by fungus Colletotrichum lindemuthianum. Camellia assamica is one of the most popular non-alcoholic beverage crops in the world. The leaf gets severely affected by fungus Alternaria alternata. Development of automatic detection system using advanced computer technology such as image processing help to support the farmers in the identification of diseases at an early or initial stage and provide useful information for its control. Therefore, the present study was carried out on automatic disease detection of plant leaf of Phaseolus vulgaris (Beans) and Camellia assamica (Tea) using image processing techniques. It involves image acquisition, image preprocessing, image segmentation, feature extraction and classification.

Keywords: Phaseolus vulgaris, Camellia assamica, image acquisition, image segmentation, feature extraction.

1. INTRODUCTION

About 70% of the India economy depends on agriculture. Due to environmental changes the crops get heavily affected and characteristics symptoms such as leaf spot, dryness, color change and defoliation occurs. Development of automatic detection system using advanced computer technology such as image processing help to support the farmers in the identification of diseases at an early or initial stage and provide useful information for its control.

Detection of leaf spot disease using following techniques such as image acquisition, image pre-processing, disease spot segmentation, feature extraction and disease classification were carried out by various workers. Proposed methodology like K-mean clustering, texture and color analysis for plant disease detection in Malus domestica. The authors reviewed various symptoms and diseases of banana leaves. Algorithms were used for the detection of disease. They also explained the importance of pattern classification for disease identification. Made study on the disease severity of leaf using image processing techniques. They used feature extraction such as threshold and triangular threshold methods. Identification of diseased leaf of blast and brown spot of rice using image processing techniques were carried out by. They used zooming algorithm, SOM neural network for disease detection. The present work has been carried out for the automatic disease detection of plant leaf of Phaseolus vulgaris (Beans) and Camellia assamica (Tea) using image processing techniques. Phaseolus vulgaris L. is an important food legume crops and provide essential diet for millions of people across the world. It is affected by various diseases out of which Anthracnose are of major importance. Anthracnose disease is caused by fungus Colletotrichum lindemuthianum. Symptoms are sunken, elongated and circular lesions appears on the leaf petiole and veins and on the under surface of the leaves. Camellia assamica is one of the most popular non-alcoholic beverage crops in the world. The leaf gets severely affected by fungus Alternaria alternata. Disease symptoms first appear as greyish, brown patches around the tip and margin of young leaves. The lesions extend towards the midrib, resulting in leaf curl, death and defoliation.

2. GENERIC BLOCK DIAGRAM

The main purpose of proposed system is to detect the diseases of plant leaves by using feature extraction methods where features such as shape, color, and texture are taken into consideration. K-nearest Neighbors (KNN) or Support Vector Machine(SVM), a machine learning technique is used in classifying the plant leaves into healthy or diseased and if it is a diseased plant leaf, KNN or SVM will give the name of that particular disease. Suggesting remedies for particular disease is made which will help in growing healthy plants and improve the productivity.

First the images of various leaves are acquired using high resolution camera so as to get the better results & efficiency. Then image processing techniques are applied to these images to extract useful features which will be required for further analysis. The basic steps of the system are summarized in the figure.

Software architecture in software engineering helps to expose the structure of a system while hiding some implementation details. Architecture focuses on relationships and how the elements and components interact with each other, as does software engineering. The image dataset is fed to the pre-processing unit, in this unit the image is resized

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to the standard format and image enhancement is done, once the image is pre-processed the image is fed to the training model this model passes the dataset to then KNN or SVM algorithm, then the algorithm is trained and the trained model is saved. Once the model is trained we can now test our images to know the type of leaf disease with prescriptions.

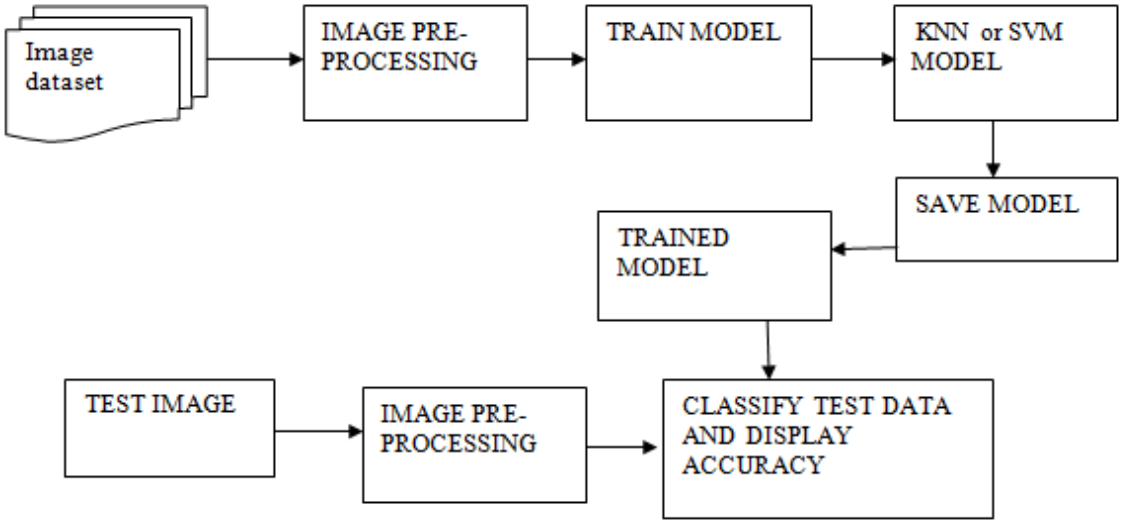

Fig: Flow chart for detection

3. K-MEANS CLUSTERING ALGORITHM:

a) Load the input images.
b) Commute the RGB image into L*a*b color space.
c) RGB images are combination of primary colors (Red, Green, and Blue).
d) RGB image feature Pixel Counting technique is extensively applied to agricultural science.
e) The L*a*b* space consists of a radiance layer 'L*', chromaticity-layer 'a*' indicating where color falls along the red-green axis and chromaticity layer 'b*' indicating where the color falls along the blue yellow axis. All of the color information is in the 'a*' and 'b*' layers.
f) Clustering the variant colors using k-mean method.
g) The Euclidean distance between two objects is defined as follows:

$$d(\mathbf{p},\mathbf{q}) = d(\mathbf{q},\mathbf{p}) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}.$$

h) Each pixel is labeled under clusters based on its estimated variant cluster-centres.

4. K- NEAREST NEIGHBOUR

K-Nearest Neighbour is one of the most straightforward Machine Learning calculations in light of Supervised Learning method.
It accepts the likeness between the new case/information and accessible cases and put the new case into the class that is generally like the accessible classifications.
It stores every one of the accessible information and orders another information point in light of the likeness. This implies when new information shows up then it tends to be handily ordered into a well suite classification by utilizing K-NN calculation.
It tends to be utilized for Regression as well with respect to Classification yet for the most part it is utilized for the Classification issues.
It is a non-parametric calculation, and that implies it makes no suspicion on basic information.

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It is likewise called a lazy learner since it doesn't gain from the preparation set quickly rather it stores the dataset and at the hour of grouping, it plays out an activity on the dataset.
In the preparation stage simply stores the dataset and when it gets new information, then, at that point, it characterizes that information into a class that is much like the new information.

Why KNN ?

Assume there are two classes, i.e., Category A and Category B, and we have another information point x1, so this information point will lie in which of these classifications. To take care of this sort of issue, we want a K-NN calculation. With the assistance of K-NN, we can undoubtedly recognize the class or class of a specific dataset.

How does it work?

- Select the number K of the neighbours
- Work out the Euclidean distance of K number of neighbours
- Take the K closest neighbour according to the determined Euclidean distance.
- Among these k neighbours, count the quantity of the data of interest in every class.
- Assign the new information focuses to that classification for which the quantity of the neighbour is most extreme.
- Our model is prepared.

How to choose K value?

There is no specific method for deciding the best value for "K", so we really want to attempt several times to find the best out of them. The most favoured value for K is 5. An exceptionally low value for K like K=1 or K=2, can be noisy and lead with the impacts of exceptions in the model. Huge qualities for K are great, however it might discover a few challenges.

4. SUPPORT VECTOR MACHINE(SVM)

Support Vector Machine(SVM) is a supervised machine learning algorithm used for both classification and regression. Though we say regression problems as well its best suited for classification. The objective of SVM algorithm is to find a hyperplane in an N-dimensional space that distinctly classifies the data points. The dimension of the hyperplane depends upon the number of features. If the number of input features is two, then the hyperplane is just a line. If the number of input features is three, then the hyperplane becomes a 2-D plane. It becomes difficult to imagine when the number of features exceeds three.

Why SVM ?

- Effective in high dimensional cases.Its memory efficient as it uses a subset of training points in the decision function called support vectors
- Different kernel functions can be specified for the decision functions and its possible to specify custom kernels

5. COMPARISON OF ALGORITHM

SVM Algorithm:

Support-vector machines are administered learning models with related learning calculations that examine information for grouping and regression analysis. In expansion to performing direct grouping, SVMs can productively play out a non-linear classification utilizing the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces. When data are unlabelled, supervised learning is not possible, and an unsupervised learning approach is required, which attempts to find natural clustering of the data to groups, and afterwards map new information to these framed gatherings. For our dataset it gave out 90% accuracy.

KNN Algorithm:

In k-NN classification, the output is a class membership. An object is classified by a plurality vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is simply assigned to the class of that single nearest neighbour. In k-NN regression, the output is the property value for the object. This value is the average of the values of k nearest neighbours. For our dataset it gave 80% accuracy.

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6. EXPERIMENTAL SETUP

MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation. Using MATLAB, you can solve technical computing problems faster than with traditional programming languages, such as C, C++, and Fortran. Matlab is a data analysis and visualization tool which has been designed with powerful support for matrices and matrix operations. As well as this, Matlab has excellent graphics capabilities, and its own powerful programming language. One of the reasons that Matlab has become such an important tool is through the use of sets of Matlab programs designed to support a particular task. These sets of programs are called toolboxes, and the particular toolbox of interest to us is the image processing toolbox. Rather than give a description of all of Matlab's capabilities, we shall restrict ourselves to just those aspects concerned with handling of images. We shall introduce functions, commands and techniques as required.

A Matlab function is a keyword which accepts various parameters, and produces some sort of output: for example, a matrix, a string, a graph. Examples of such functions are sin, imread, imclose. There are many functions in Matlab, and as we shall see, it is very easy (and sometimes necessary) to write our own. You can use MATLAB in a wide range of applications, including signal and image processing, communications, control design, test and measurement financial modeling and analysis. Add-on toolboxes (collections of special-purpose MATLAB functions) extend the MATLAB environment to solve particular classes of problems in these application areas. MATLAB provides a number of features for documenting and sharing your work. You can integrate your MATLAB code with other languages and applications, and distribute your MATLAB algorithms and applications. When working with images in Matlab, there are many things to keep in mind such as loading an image, using the right format, saving the data as different data types, how to display an image, conversion between different image formats. Image Processing Toolbox provides a comprehensive set of reference-standard algorithms and graphical tools for image processing, analysis, visualization, and algorithm development. We can perform image enhancement, image deblurring, feature detection, noise reduction, image segmentation, spatial transformations, and image registration.

CONCLUSION

There are number of ways by which we can detect disease of plants and suggest remedies for them. Each has some pros as well as limitations .On one hand visual analysis is least expensive and simple method, it is not as efficient and reliable. Image processing is a technique which is most spoken for very high accuracy and least time consumption are major advantages offered. The applications of K-means clustering have been formulated for clustering and KNN (K Nearest neighbor) and SVM (Support Vector Machine) is used for classification of diseases that effect on plant leaves. Recognizing the disease accurately and efficiently is mainly the 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.

The present study deals with automatic disease detection of plant leaf using image processing techniques. It involves image acquisition, image preprocessing, image segmentation, feature extraction and classification. Development of automatic detection system using advanced computer technology such as image processing help to support the farmers in the identification of diseases at an early or initial stage and provide useful information for its control. We would like to extend our work further on more plant disease detection.

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