Image processing and Pattern Recognition based Plant Leaf diseases Identification and Classification

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Abstract: The relationship between plants and folks are long-lasting and continuous one as we know plants are having major priority plants play an awfully necessary role in our lives. We tend to rely on plants for food, medicines, soaps, furniture, textiles, etc., therefore it's terribly crucial for us to early observe various styles of diseases in plants to induce higher yielding. Identification of those plant diseases by Oculus technique is incredibly troublesome and time overwhelming. If identification is inaccurate then there would be a large loss in crops and economical worth of market. Therefore, to resolve these issues and to induce higher returns, we are able to use Image process techniques Laptop assisted technology continually provides higher accuracy than the manual work. Therefore, during this research, we tend to perform segmentation using k-means clustering and classification of diseases using Support Vector Machine classifier.

Key words--Median filter, k-means clustering algorithm, and histogram based classification, SVM (Support Vector machine).

I. INTRODUCTION
Agriculture is the backbone of India’s economy. Agriculture is vital not for the provision of food however conjointly for purveying completely different raw materials for big, tiny, and medium scale industries. It's not solely Associate in Nursing occupation, however conjointly method of life. Most customs and cultures within the world revolve around Agriculture. We begin to determine, therefore, the importance of selecting our surroundings with the simplest of care, as a result of surroundings is that the mental feeding ground out of that the food that goes into our minds is extracted that. Distinguishing the condition of plant plays a vital role for booming cultivation. In past day's identification is completed manually by the old folks. However because of numerous environmental changes the prediction could go wrong and changing into robust. Therefore, we are able to use image process techniques for identification of diseases in plants. Usually, we are able to observe the symptoms of non wellness in several elements of plant like leaf, flowers, stems, etc., So, during this thesis, plant leaf samples taken from various plants are collected, and that they are processed more for the un-wellness identification. This work primarily focuses on the identification of the four styles of diseases regularly effected diseases causes by different symptoms types in plant leaves referred to the categories of Fungi, Alternaria AlternataAnthracnose types and, micro-organism Blight and Cercospora Leaf Spot etc.

2. LITERATURE REVIEW
S.M Jai Sakthi et.al [1] planned Grape plant disease identification victimization machine learning techniques during the research which the paper in the main concentrates on distinguishing the 3 kinds of diseases in grape plants like plant leaf disease, Esca, blight. this method segments the leaf from the background image victimization grab cut segmentation method. The morbid half is further known by victimization 2 ways like international thresholding and semi-supervised technique.

Saradhambal G et.al [2] planned disease detection and its answer victimization image classification. this method in the main focuses on the identification of 4 kinds of plant diseases caused by microorganisms, viruses, flora, and pathogens. As she planned an increased k-means clustering bunch algorithmic rule to anticipate the contaminated zones of the leaf and color primarily based sectionation model to fragment the contaminated region and embedding it to its relevant diseases.

Sujatha.R et.al [3]. Planned and obtained the results of plant disease detection victimization image process. In this paper, the feature extraction is performed on different pictures. In this paper the authors advised K-means bunch for image segmentation and SVM technique for the sickness of the leaf classification.

B.N.Li.et.al [6] determines that the execution of the segmentation is vulnerable and that ideal style of dominant parameters, that want tidy manual mediation. Another Fuzzy level set calculation is enclosed during this paper to encourage healthful different plant leafs Image division. Execution assessment of the planned calculation was carried on healthful pictures from various modalities. The outcomes affirm its adequacy for restorative Image division.

3. PROPOSED PLANT DISEASE IDENTIFICATION AND CLASSIFICATION METHODOLOGY:

The proposed method is shown in figure below figure:

![Proposed System Diagram]

As stated in the Fig 1, the proposed method uses four major steps they are:
The 1st step is contrast enhancement.

The 2nd step is segmenting the diseased and undiseased leaves using color image segmentation techniques.

The third step is extracting the different features.

Last step is categorizing the four types of diseases and providing the solutions.

**Step 1: Pre-Processing**

1. **Image Acquisition:**
   It is the creation of a digitally encoded illustration of the visual characteristics of the object in image processing. The essential phase of any vision framework is the picture acquisition stage to take the pictures. When the picture has been gotten various methodologies of the process are applied to the picture to perform the various extraordinary vision tasks needed. Nonetheless, in the event that the picture has not been non-heritable agreeably, at that point the alleged framework undertakings probably won't be feasible. As in fig.2 infected leaves to be considered for testing to determine the type and classification of disease. Image acquisition can bring remaining steps for the disease identification and classification. This process is used to analyze to take the image rails for doing any kind of analysis based on images here we considered plant leaf images.

![Infected leaf](image1)

**Fig 2: Infected leaf**

2. **Contrast Enhancement:** Options stand out a lot clearly by creating the best use of the colours obtainable on the show or output device as shown in fig3. Distinction manipulations involve ever-changing the vary of values in a picture to extend distinction. It plays a crucial role within the image method to acquire the information that exists within that of grey-level image. To improve the quality of an image, we need to perform different operations.

![Contrast Enhanced](image2)

**Fig 3: Contrast enhancement output**

**Step 2: Feature Extraction:**

In pattern recognition and in processing of images, feature extraction plays a vital role in order to acquire features from the raw image. Once the computer file to associate rule is simply too massive to be processed and it's suspected to be famously repetitive then the input file area unit getting to be reworked into a reduced illustration set of options.

1. **Contrast:** It is described as the division between the most brilliant and the haziest territory of the image.
Contrast = \sum_{i,j=0}^{n-1} P_{ij}(i-j)^2

2. Correlation: we can measure the linearity of an image from +1 to -1

\text{Correlation} = \sum_{i,j=0}^{n-1} \frac{(i-\mu)(j-\mu)}{\sigma_i \sigma_j}

3. Entropy: It is the proportion of vulnerability in an irregular variable.

\text{Entropy} = \sum_{i,j=0}^{n-1} \ln(P_{ij})P_{ij}

1. Energy: It gives the amount of squared components in Grey level co-occurrence matrix (GLCM).

\text{Energy} = \sum_{i,j=0}^{n-1} (P_{ij})^2

2. Homogeneity: It quantifies the closeness of the conveyance of the components in dim level co-event grid to the dim level co-event framework by restoring a worth that ranges between 0 and 1.

\text{Homogeneity} = \sum_{i,j=0}^{n-1} \frac{p_{ij}}{1 + (i-j)^2}

Step 3: Segmentation of Colour image

It is performed on the colour feature of image pixels. Here we are assuming that homogeneous colours within the image belong to the different clusters and hence important things within the colour image. Each cluster defines a category of pixels that share similar colour properties. In this paper we use k-means clustering based color image segmentation to perform the required proposed work.

Clustering:

Clustering may be defined as a method of organizing objects into groups whose members are behaving in similar way. A cluster is therefore a set of objects that are similar within one cluster and are dislike to the objects belonging to other different clusters.

K-means Clustering:

K-means clustering is also a technique of vector division, that divide different number of observations into different clusters inside which each observation belongs to the cluster with the nearest mean), serves as a model of the cluster. This prompts a dividing of the data zone into Voronoi cells. It’s standard for cluster analysis in signal processing as in the fig. 4. K-means agglomeration reduces inter-cluster variances, which might be the tougher Weber problem.

Colour based segmentation using K-means Clustering:

1. Read the given picture.
2. Convert the picture from RGB colour space to L*a*b colour space.
3. Classify the tones in in a*b space by utilizing K-means clustering.
4. Make pictures that section the H&E image by colour.
5. Fragment the Nuclei
Step 4: Disease Classification:

SVM Classifier: SVM may be a regulated AI algorithmic program that may be utilized for every classification or regression challenges in image processing. Nonetheless, it’s essentially utilized in classification tasks. At that point, we will in general perform order by finding the hyper-plane that separates the 2 categories accurately. Here, we've got hyper-plane. the most task is to spot the proper hyper-plane to classify the weather. We’d like to spot the thumb rule to spot the proper hyper-plane. A Support Vector Machine (SVM) gives the analysis of classification by obtaining the hyper plane that maximizes the margin between the two classes. The vectors that outline the hyper plane are the support vectors.
4. EXPERIMENTAL RESULTS:

**Fig 5:** SVM Classifier Example

**Fig 6:** Anthracnose diseased leaf
Fig 7: Anthracnose disease preventing measures

Fig 8: Alternaria alternate diseased leaf

Fig 9: Alternaria alternate preventive measures
Fig 10: Bacterial Blight diseased plant

Fig 11: Bacterial blight preventive measures

Fig 12: Healthy grape leaf
CONCLUSIONS AND APPLICATIONS:
This paper was implemented by SVM Classifiers for the analysis of morbid leaves and morbid leaves collected to detect the diseases type and classification for various plant leaves were collected and that they were tested any for the identification of the illness inflicting bacterium, virus, fungi, and pathogens etc. The affected space is calculated and provided careful preventive measures to cure the diseases. So we will bounce back output from the plants. This work uses colour image segmentation for the separation of morbid and international organization morbid leaves and Support Vector Machine classifier for identification of the illness inflicting organism and kind of illness as we shown in the results. Therefore it offers accuracy up to 98.125%. There would be an extra scope to extend the accuracy and exactitude. The foremost use of this planned system is at cultivation and harvest.

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