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NOVEL ALGORITHM FOR GRAPE LEAF DISEASES DETECTION

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Abstract-Early and reliable detection of leaf diseases has important practical relevance, especially in the context of precision agriculture for localized treatment with fungicides. Techniques that can significantly identify leaf diseases would assure fruit quality and minimize losses for Grape fruit farms. Procedures for selecting useful texture features were developed based on a stepwise analysis.. This paper presents approach for integrating image analysis techniques into diagnostic expert systems. The result of applying this approach is presented through the use of grape diseases as a case study

Keywords – Hue, Energy, homogeneity, contrast, cluster prominence and cluster shade.

Introduction

India is an agricultural country; wherein about seventy percentage of the population depends on agriculture .Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. However, the cultivation of these crops for optimum yield and quality product is highly technical. It can be improved with the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life. Grape fruit enjoys a pre-eminent status among all cash crops in the country and is the principal raw material for flourishing wine industry. It provides livelihood to about sixty million people and is an important agricultural commodity providing remunerative income to millions of farmers both in developed and developing countries. Country 70 per cent of the grape cultivated area in India is under rain fed conditions. Water stressed seed or plant, will have poor growth leading to low yield as well as exposure to diseases.

Producing Grape is a daunting task as the plant is exposed to the attacks from various microorganisms ,bacterial diseases and pests .The symptoms of the attacks are usually distinguished through the leaves ,stems or fruit inspection . This proposed system discusses the effective way used in performing detection of grape diseases through leaf feature inspection. Leaf image is captured and proposed to determine the health status of each plant. Plant disease diagnosis is an art as well as science. The diagnosis process (i.e. recognition of symptoms and signs) , is inherently visual and requires intuitive judgment as well as the use of scientific methods. Photographic images of symptoms and signs of plant's diseases used extensively to enhance description of plant diseases are invaluable in research, diagnostics etc.

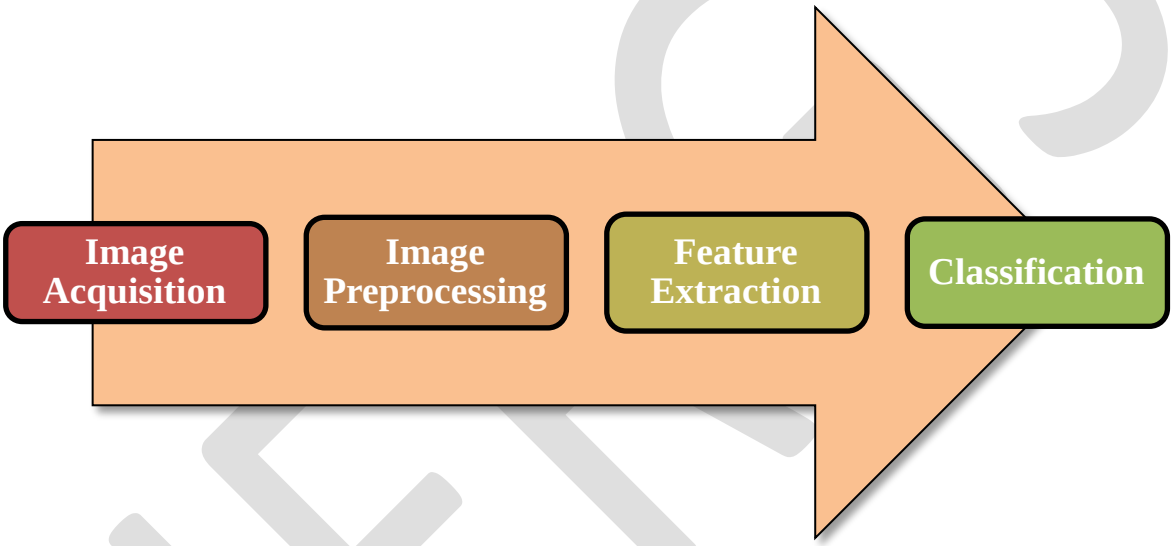
At certain times, it becomes a very high demand in the market because supply is limited. Business grape indeed belongs in the high-risk plants. Therefore, strategies and technical knowledge and the field became an important matter to be mastered. The systematic and structured should be developing so that it will use by operators to increase the overall production. Many farmers refused to cultivate grape in the rainy season due to the increase of grape disease to become high risk for the quality control and productivity. In general, there are two types of factors which can bring death and destruction to grape plants; living (biotic) and nonliving (a biotic) agents. Living agent's including insects, bacteria, fungi and viruses. Nonliving agents include extremes of temperature, excess moisture, poor light, insufficient nutrients, and poor soil pH and air pollutants. Diseased plants can exhibit a variety of symptoms and making diagnosis was extremely difficult. Common symptoms are includes abnormal leaf growth, colour distortion, stunted growth, shriveled and damaged pods. Although pests & diseases can cause considerable yield losses or bring death to the plants and it's also was directly affect to human health. However, crop losses can be minimized, and specific treatments can be tailored to combat specific pathogens if plant diseases are correctly diagnosed and identified early. These need-based treatments also translate to economic and environmental gains.

Materials and methods

Kim et.al, have classified the grape fruit peel diseases using colour texture features analysis. The texture features are calculated from the SGDM and the classification is done using squared distance technique. Grape fruit peel might be infected by several diseases likecanker, copper burn, greasy spot, melanose and wind scar [1]. In [2] the authors have worked on the development of methods for the automatic classification of leaf diseases based on high resolution multispectral and stereo images. Leaves of sugar beet are used for evaluating their approach. Sugar beet leaves might be infected by several diseases, such as rusts (Uromyces betae), powdery mildew (Erysiphe betae). Zulkifli Bin Husin and Abdul Hallis Bin Abdul Aziz developed fast and accurate method in which the chilli leaf diseases are detected using colour clustering method. Here graphical user interface is used [3]. Yinmao Song et al, developed feature extraction methods of crop disease based on computer image processing technology. Based on colour, texture and shape feature extraction method in three aspects features and their respective problems were introduced start from the perspective of lesion leaves[4]. Keru Wang et al [5] created a model of cotton leaf chlorophyll determination based on using the machine vision technology

for the colour features of cotton leaf. The research showed that the BIR values of RGB colour system, the b and b\r values of chromaticity coordinate and the S values of HIS colour system were all significantly correlated with chlorophyll content of cotton leaf. These values could be used to determine the concentration of chlorophyll. Libo Liu et al [6] studied the identification method of rice leaf disease according to the colour characteristics of leaf lesion area. Al-Bashish, Braik and Bani Ahmed developed a fast and accurate method in which the leaf diseases are detected and classified using k-means based segmentation and neural networks based classification [7]. Automatic classification of leaf diseases is done based on high resolution multispectral and stereo images [8]. Sugar beet leaves are used in this approach. Segmentation is the process that is carried out to extract the diseased region and the plant diseases are graded by calculating the quotient of disease spot and leaf areas. An optimal threshold value for segmentation can be obtained using weighted Parzen-window [9]. This reduces the computational burden and storage requirements without degrading the final segmentation results. In [10], a fast and accurate new method is developed based on computer image processing for grading of plant diseases. For that, leaf region was segmented by using Otsu method [11, 12, & 13]. After that the disease spot regions were segmented by using Sobel operator to detect the disease spot edges. Finally, plant diseases are graded by calculating the quotient of disease spot and leaf areas.

Basic Procedure



Above figure shows the basic procedure of grape leaf disease classification.

Image Acquisition

Here first we captured the image. Image must be stored in the ('.jpg') format. Size of the image is 259*194 pixcels. We open this image using imread command in MATLAB software

Image Pre-processing

We convert the image into HSV format using rgb2hsv command. After this transformation we consider only Hue component. We neglect saturation and intensity component. Because it does not provide any useful information.

$$\text{Hue (H)} = \begin{cases} \emptyset & \text{if } B \leq G \\ 360 - \emptyset & \text{if } B > G \end{cases}$$

$$\emptyset = \cos^{-1}\left\{\frac{1/2[(R-G)+(R-B)]}{[(R-G)^2+(R-G)(G-B)]^2}\right\}$$

$$\textbf{Saturation (S)} = 1 - \frac{3}{R+G+B}[\min(R,G,B)]$$

$$\textbf{Value (V)} = \frac{1}{3}(R+G+B)$$

Masking of green pixels of hue component take place. Because green pixcels are nothing but healthy region of the leaf. It can not give any additional information for disease classification. Here we concentrate only on infected region. The infected portion of the leaf is extracted.

Feature Extraction

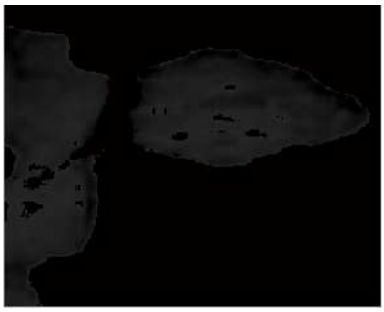
Then we extract the features of diseased area and classify the disease according to the features. For this we use Spatial Gray-level Dependence Matrices (SGDM matrix) method. By using SGDM matrix method we get five features like Energy , homogeneity, contrast, cluster prominence and cluster shade. But only cluster prominence and cluster shade give significant difference in their value . Value of Energy, homogeneity, contrast of all the diseases is almost same. We are focusing on cluster prominence and cluster shade component. .Here we avoid the segmentation process. Due to this we classify the black rot and downy mildew or black rot and powdery mildew diseases successfully but we cannot classify downy mildew and powdery mildew disease successfully. Because the value of the component of these two diseases nearly same for this we have to use segmentation process.

$$\text{Cluster Shade} = \sum_{i=0}^{G-1}\sum_{j=0}^{G-1}\{i+j-\mu_i-\mu_j\}^3 \times P(i,j|\Delta x,\Delta y)$$

$$\textbf{Cluster Prominence} = \sum_{i=0}^{G-1}\sum_{j=0}^{G-1}\{i+j-\mu_i-\mu_j\}^4 \times P(i,j|d)$$

Black Rot

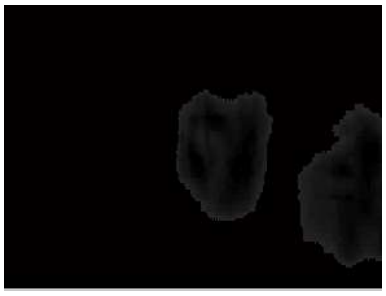




RGB Image Mask Image Hue Image

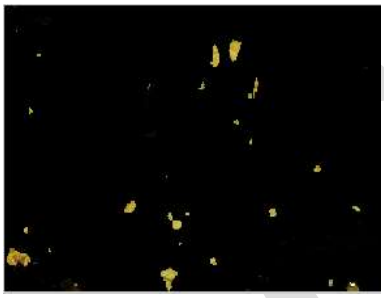
Powdery Mildew





RGB Image Mask Image Hue Image

Downy Mildew




RGB Image Mask Image Hue Image

Above figure shows different images during processing. After taking RGB image we mask infected region and then extract features of that infected portion.

Experimental Result

About 100 plant leaves of different native plant species of Maharashtra state have been collected for analysis Without Segmentation

Sr. No.	Disease	Accuracy
1	Black Rot	95%
2	Powdery Mildew	40%
3	Downy Mildew	40%

Conclusion

This approach provides technical hand to agriculture field. The proposed approach is verified with real time plant leaf data base. To improve the accuracy of classification we must add Segmentation block in the main procedure also time required for the same is also less. This approach is useful for farmers for early detection of grape leaf disease which improve the production cost.

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