Study and Identification of Powdery Mildew Disease for Betelvine Plant Using Digital Image Processing With High Resolution Digital Camera

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Abstract - *Piper betel Linn. (Family Piperaceae) commonly known as the betel vine in English and Paan in Hindi, is an important medical, religious and traditional plant in all over world. In India and in other countries of the world which may include over 2 billion consumers. Its cultivation is highly labor demanding and offers employment to about 2.0 million families engaged in cultivation, trading and commerce in betel leaf throughout India. The aim of this paper is to detect and identify powdery mildew disease in betelvine plants using digital image processing techniques. The high resolution digital images of the normal betelvine leaves and the infected in powdery mildew diseased betelvine leaves are collected from different Betelvine plants using a high resolution digital camera and images are stored with JPEG format. The digital images of the betelvine leaves analyses are done using the MATLAB. Using RGB encoding process, the RGB components of the betelvine leaves are separated. The mean values for all sample leaves are computed and values are stored in the system. Calculated Values are compared with normal and infected leaves as the result of this comparison, it is identified whether leaves are affected by powdery mildew disease or not. Finally this analysis helps to recognize the powdery mildew disease can be identified before it spreads to entire crop.*

Key Words: Betelvine, Odium piperis, powdery mildew.

1. INTRODUCTION

The betel vine leaf is mainly used to conventional medicines for the treatment of stomach complaints, infections. Some evidence suggests that betel vine leaves have immune boosting properties as well as anticancer properties. Lots of analysis is going on in the field of betel vine diseases. Essentially when a farmer see the Powdery mildew disease for betel vine plant is in the developed stage after which identification cannot save the plant.[1] The Powdery mildew disease spreads to the complete crop and the total plantation get damaged within few days. Human eye cannot visualize the Powdery mildew disease at an initial stage. So we are using computerized image analyzing system in which minute change in the form of color in leaves can be detected at an early stage. The group of research is going on in the field of betel vine plants disease analysis for various research centers within the country under the name "ALL INDIA COORDINATED RESEARCH PROJECT ON BETEL VINE" the disease well in advance to enhance the cultivation. Digital Image processing is used as a tool for early identification of the powdery mildew disease. [2]

2. POWDERY MILDEW DISEASE

Powdery mildew is the main sourced from Odium piperis. The disease shows on the undersurface of the leaves as white to brown powdery patches. The photograph is shown in figure 1 and figure 2 for front and back view of Powdery mildew infected betelvine leaf.

Fig. 1 Front view of betelvine leaf

Fig. 2 Back View of betelvine leaf

These infected areas gradually increase in size and repeatedly combine with each other. They vary in size from a few to 40mm in diameter and are covered by dusty growth which is fairly thick in cases of sever attack. Surface appears yellowish, raised and irregular in outline. Young leaves when attacked fail to grow and become deformed, the surface being cracked and the margin turned inwards. Such leaves present a pale appearance and drop with slight disturbance. The disease is more prevalent in old plantations.[3]

3. PROBLEM STATEMENT:

Pictures are the most common and convenient means of conveying or transmitting information. A picture is worth a thousand words. Pictures concisely convey information about positions, sizes and inter-relationships between objects. They portray spatial information that we can recognize as objects. Human beings are good at deriving information from such images, because of our innate visual and mental abilities. About 75% of the information received by human is in pictorial form. At the initial stages of powdery mildew disease cannot be detected with our necked eyes keeping the fact in mind if we use such image which gives detail information. [4]

4. PROPOSED SOLUTION WITH NEW ALGORITHM

Using higher resolution images powdery mildew disease can be identified and detected. Algorithm is discussed to enhance the vision clarity, to enrich its perceptive view. Direct observation and recorded color images of the same scenes are often strikingly different because human visual perception computes the conscious representation with vivid color and detail in shadows, and with resistance to spectral shifts in the scene illuminant. This chapter presents a new technique for color enhancement in the compressed domain. The proposed technique is simple but more effective than some of the existing techniques reported earlier. The novelty lies in this case in its treatment of the chromatic components, while previous techniques treated only the luminance component. This is simplified with the usage luminance component because it adjusts the brightness alone. Thus results of all previous techniques along with that of the proposed one are compared with respect to those obtained by applying a spatial domain color enhancement technique that appears to provide very good enhancement. The proposed technique, computationally more efficient than the spatial domain based method, is found to provide better enhancement compared to other compressed domain based approaches. Color image processing is divided into two major areas: full-color and pseudo color processing. Every image is on the bases of color, contrast and brightness, these three primary elements are altered in order to obtain enhanced image. Thus direct observation and recorded color images of the same scenes are often strikingly different because human visual perception computes the conscious representation with vivid color and detail in shadows, and with resistance to spectral shifts in the scene illuminant.

1. Read the Image.
2. Resize that image for applying DCT Compression.
3. Convert into y cb cr color space
4. Convert luminance part of the input image into vector.
5. Calculate the scaling coefficient from this image.
6. Apply DCT for all three color spaces.
7. Convert image into vector for this compressed images.
8. Apply the scaling coefficient into compressed image in all three color spaces.

I. For brightness Scale Only DC Coefficients.
II. For contrast Scale DC and AC Coefficients.
III. For color Scale DC and AC Coefficients using function (Use all three colors Information)

9. Convert vector into image.
10. Apply inverse DCT.
11. Convert into RGB color space.

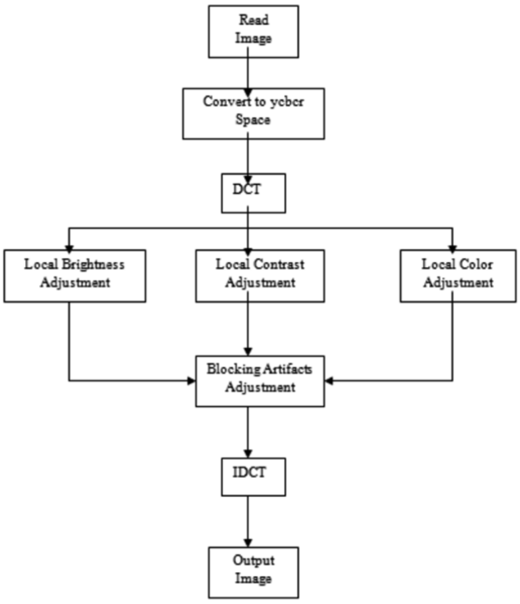

Fig.3 Encoding and decoding RGB information process

Encoding and decoding process preserve following parameter

4.1 Preservation of local contrast

Contrast, which we define as the difference in intensity between the highest and the lowest intensity levels in an image. The concept of contrast simultaneous is related entirely to the perceived brightness does not depend simply on its intensity; they appear to the eye to become darker as the background gets lighter [6 - 8]. The basic idea of our algorithm is to filter the image by manipulating the DCT coefficients according to the contrast measure defined. The proposed algorithm has the following advantages: 1) the algorithm does not affect the compressibility of the original image; 2) given a majority of zero-valued DCT coefficients (after quantization), the algorithm expense is relatively low; and 3) the proposed image enhancement algorithm is applicable to any DCT-based image compression standard, such as JPEG, MPEG.

4.2 Preservation of color

By extensive analysis with several video sequences, we observed that the statistical distribution of the color is in typical applications is closer to the enhancement. These techniques only change the luminance component (Y) and keep the chrominance components (Cb and Cr respectively) unaltered. Though in the Y - Cb – Cr color space the chrominance components are decorrelated better than that in the R - G – B color space, the increasing values in the Y component usually tend to desaturate the colors. Typically one may observe from the conversion matrix for going from the Y - Cb – Cr space to the R - G - B space, for G > R and G > B increasing Y while keeping Cb and Cr unchanged reduces both the (R/G) and (B/G) factors[3,4]. This is why we believe that the chromatic components should be also processed for preserving the colors.

4.3 Algorithm for color enhancement by scaling (CES)

Input: Y, U , V : DCTs of three components of a block.
Input Parameters: f(x) (the mapping function) , Imax , Bmax , κ , σthresh , N(Block size).
Output: $\ddot{U}$, $\tilde{V}$, $\dot{Y}$.
1. Compute σ and μ.
2. If (σ > σ thresh) ,
2a. Decompose into (N/2) x (N/2) DCT sub-blocks,
2b. For each block apply similar computations as described
in Steps 3 through 5, and
2c. Combine 4 of these (N/2) x (N/2) blocks into a single NxN DCT block and return.
3. Compute the enhancement factor (κ) as follows:
3a. κ = (f(Y(0,0)/N.Imax)) /(Y(0,0)/N.Imax) ,
3b. κ = min(κ, (Bmax / μ + k σ) and
3c. κ = max(κ,1)
4. Scale the coefficients:
4a. $\dot{Y}$ = κ Y, and
4b. Apply (11) and (12) on U and V for preserving colors.

4.4 Comparison of Results with the Previous Approach

We have compared the performance of the proposed approach with that of three existing DCT domain color enhancement techniques, namely alpha-rooting, multicontrast enhancement technique, multicontrast enhancement coupled with dynamic range compression and contrast enhanced by scaling [5 - 7].
A. Alpha Rooting (Ar)
The computation according to Alpha rooting it requires 1 Multiplication and 1 exponentiation operation. Hence, the computational complexity can be expressed as 1M + 1E per pixel.
B. Multicontrast Enhancement (MCE)
Computation of the cumulative energies for both enhanced and original blocks requires 126 additions (ignoring the cost of absolute operations). For computing Hn , 1 ≤ n ≤ 14, 14 divisions are required and finally the scaling of the AC coefficients requires two multiplications each. The total number of operations for each block is thus 140 multiplications and 126 additions. Hence, the number of operation per pixel becomes 2.19M + 1.97A.
C. Multicontrast Enhancement with Dynamic Range Compression (MCEDRC) As this technique L2 uses norm, the computation of cumulative energies becomes more expensive than the previous technique. In this case, the number of operations is 128 Multiplications and 126 Additions [7]. In addition, the dynamic range compression requires the computation of the function (x) with 2exponentiation and 2 addition operations. Considering all

other factors similar to the previous one, the per pixel operation can be expressed as 0.03E + 3.97M + 2A.

D. Contrast Enhancement by Scaling (CES)

In this algorithm, the scaling of the coefficients by a constant for each component is the major computational task. This would require 192 multiplications and four additions. The additions are necessary for translating (and retranslating back) the DC coefficients of the Cb and Cr components [9]. Computation of the scaling factor depends on the type of functions used. In addition, there is an overhead of computing the standard deviation (σ) and the mean (μ) of the block, which requires 63 multiplications, 62 additions and one exponential operation (square root).[5]

5. EXPERIMENT

Normal leaves phase consists of without any disease infected in the betelvine leaf. Fully Infected leaves phase consisted of visually identifiable infected leaf, samples are collected for normal leaves and various stages of Powdery mildew disease. Test leaves phase consists of visually unidentifiable infected leaf, samples are collected at various stages of the Powdery mildew disease samples from each phase were taken for this paper. The size of all the digital images are 256 x 256.To eliminate the background using photo shop 7.0 and background was chosen to be white and these digital images are stored in the system. This stored digital images are given as input to the MATLAB file and the R,G,B color components are separated and find the mean and median values for all healthy and infected leaves and calculated values are stored in the system. For the test leaf, compute mean values and compare all the stored. [4]

Fig.4. Non-Infected Image Of Betel Vine With High Resolution

```
result_high_res=[59.53 64.90 5.6776
    38.35 62.67 0.99
    47.68 77.88 1.20
    56.55 76.04 2.04
    39.42 70.60 1.26
    41.73 65.84 1.36];
```

Fig.4.1. Mean Value of RGB For High Resolution Non Infected Image

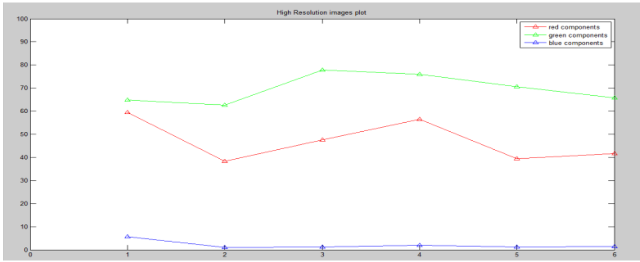

Fig.4.2. Non-infected Image of Betel vine with High resolution Graph

In fig. 4 shows Non-Infected Image of BetelVine with High Resolution, in this way three samples are taken, for which six images are captured that is for front and back side. Different mean values are calculated for RGB component in fig.4.1 and graph is plotted in fig.4.2

Fig 5 .Infected Image of Betel vine with High Resolution

```
infected_hi_reso=[31.3895 52.7806 6.0294
    32.7511 30.7186 7.6246
    40.3731 60.7052 12.2616
    33.6602 24.5040 6.7269
    40.9134 64.8681 17.5420
    32.2884 10.8902 2.9101
    46.1774 67.1099 14.3079
    42.1295 63.4914 16.9166
    38.8807 61.2610 13.8115
    33.6937 21.9165 6.3102
    39.4207 56.6189 18.5119
    33.6086 32.1863 9.7510
    47.0348 39.7195 18.9362
    23.6452 22.7650 6.9726
    30.5924 51.3415 8.8824
    31.3213 34.8829 8.6702
    38.7507 58.4350 12.7855
    32.3276 25.6895 5.6147
    44.5665 65.4134 13.5179
    38.5399 56.3454 10.6176];
```

Fig 5.1 Mean Value Of RGB For High Resolution Infected Image

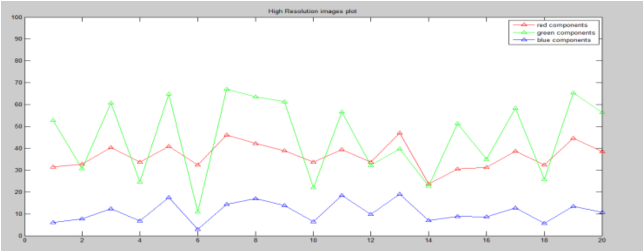

Fig 5.2 Mean Value Of RGB For High Resolution Infected Image

In fig. 5 shows Infected Image of BetelVine with High Resolution, in this way ten samples are taken, for which twenty images are captured that is for front and back side. Different mean values are calculated for RGB component in fig.5.1 and graph is plotted in fig.5.2

Fig.6 Non-infected Image of Betel vine with Low resolution

```
result_low_res=[72.12 70.34 9.62
      68.24 60.75 7.29
      57.34 96.45 6.23
      56.21 77.45 2.34
      70.34 85.12 3.45
      66.22 69.36 6.34];
```

Fig.6.1 Mean Value of RGB For High Resolution Non Infected Image

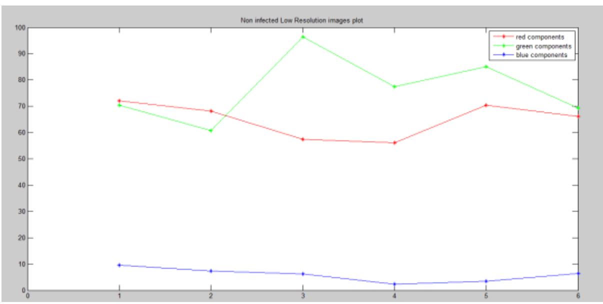

Fig. 6.2 Non-infected Image of Betel vine with Low resolution Graph

In fig. 6 shows Non-Infected Image of BetelVine with Low Resolution, in this way three samples are taken, for which six images are captured that is for front and back side. Different mean values are calculated for RGB component in fig.6.1 and graph is plotted in fig.6.2

Fig 7 Infected Image of Betel vine with Low Resolution

```
result_low_res=[54.4869 43.5661 14.7423
      59.5215 51.6567 22.1149
      47.8614 39.9341 14.3911
      56.7590 38.2532 19.9753
      54.3303 42.2984 12.6978
      67.8551 53.8361 21.5011
      51.4672 49.1995 17.6172
      60.8754 45.2951 22.6679
      51.0918 46.2298 18.0793
      50.5866 45.5403 16.2734
      58.6641 40.6442 21.3218
      51.3047 46.0873 15.9856
      58.8240 41.5685 22.9686
      46.0516 34.6235 12.1713
      58.2915 39.8124 19.3750
      47.9111 40.0641 16.6147
      49.7689 29.0877 13.9493
      50.9575 46.7148 17.6246
      58.1916 42.2584 21.8414
      46.2463 35.4124 13.9934];
```

Fig 7.1 Mean Value Of RGB For Low Resolution Infected Image

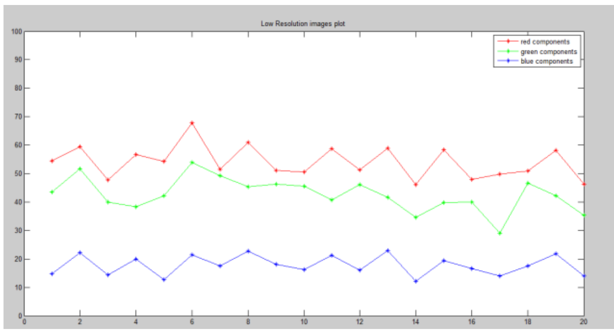

Fig 7.2 Infected Image of Betel vine with Low Resolution.

In fig. 7 shows Infected Image of BetelVine with Low Resolution, in this way three samples are taken, for which six images are captured that is for front and back side. Different mean values are calculated for RGB component in fig. 7.1 and graph is plotted in fig. 7.2

6. CONCLUSION

By doing analysis of the entire graph, as compared to low resolution images, rate of disease reorganization is increased with high resolution images.

7. FUTURE SCOPE

An App can be designed for mobile with help of which the above method can be applied direct in agricultural field on spot evaluation of disease whether crop is infected or not

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