Adaptive Filter to Improve the Paddy Images

A. SenthilRajan

***Abstract* — This paper presents a method for a contrast enhancement of disease affected on paddy image. The method consists of five filters used consecutively. The first filter is 5x5 average filters, the second filter is 21x21 adaptive averaging filters and third filter is 3x3 unsharp filter, median filter and ASF. The method is demonstrated on the disease affected paddy images. The results of the methods are evaluated visually. The presented method improves delectability of the disease affected paddy image. The noise level is also significantly reduced. It shows that adaptive smoothing filter aiming is to improve the visibility and delectability of the disease affected paddy and also to improve the productivity. The proposed method is able to enhance image data by removing noise without significantly blurring the structures in the image.**

***Keywords*—Adaptive averaging filter, Average filter, Median filter, Diseases, and Paddy**

I. Introduction

Human investigation on paddy is used in nowadays. Using a digital image processing to investigate the paddy disease especially the leaf folder diseases is very effectively controlled and eradicate efficiently. The possibility of automated processing of the images could improve our knowledge of the paddy disease. First step in order to successfully process the image is an automated detection of the paddy leaf. The detection is difficult since the images taken from the camera are very noisy. Noise and resolution are two major factors to influence paddy image quality. Images with low noise and high resolution are desirable in paddy diagnosis of diseases. In order to acquire the desired image quality, many image enhancement algorithms have been developed. However, conventional enhancement algorithms reduce image noise at the expense of blurring of lines and edges of the image. To cope with this issue, some techniques such as adaptive filters and anisotropic adaptive filtering have been proposed. Nevertheless, most of these adaptive filters are useful for specific applications. In real time applications this techniques are time consuming.

In the present study the proposed adaptive smoothing filter and unsharp filter aiming to improve the visibility and delectability of the paddy disease. The proposed technique can enhance image data by removing noise without significantly blurring the structures in the image. The advantage of this approach is its simplicity of processing, which in turn reduces computation time. In this method there are two reference values, standard deviation and slope ratio of the image on interest, to respectively describe the extent of noise reduction and edge blurring of the images enhanced by the proposed technique. By measuring the standard deviation and slope ratio the optimal conditions used for our proposed image enhancement can be determined.

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II. ADAPTIVE AVERAGING FILTER

The first step of the method is applying a 5X5 averaging filter to the image. The second step is usage of an adaptive averaging filter. First binary mask has to be determined. Each pixel (m,n) of the image I is assigned to a 21X21 window W centered on the pixel. The point I(k,l) in the binary mask of the size W is assigned a value zero if

$$\left| I(k,l) - I(m,n) \right| > t$$

Otherwise the point is assigned value one. The pixel P(m,n) in the processed image is obtained as $P(m, n) = M(m, n)$

Where $M(m,n)$ is the mean value of the pixels from image

I labelled by the determined binary mask as ones. The calculated mask depends highly on a selected threshold t . In this method the threshold is selected manually using only small number of visual iterations.

III. UNSHARP FILTER

The common method for the sharpening of an image is adding a high passed version of the image. This results is the enhance version of the given picture. The 3X3 unsharp filter is used in
the method and the filter impulse response h is given by

$$h = \frac{1}{\alpha+1}\begin{pmatrix} -\alpha & \alpha-1 & -\alpha \\ \alpha-1 & \alpha+5 & \alpha-1 \\ -\alpha & \alpha-1 & -\alpha \end{pmatrix}$$

Where the ∝ is set to 0.2

The original image before any filtering is shown if Figure 1. It is clearly visible that the image is noisy. The disease affected paddy is difficult to be distinguished from the surrounding paddy in the paddy filed.

Figure 1The original image taken from the paddy field

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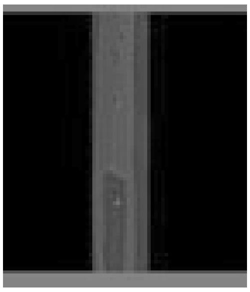

Figure 2.Containing the disease before applying the filtering methods.

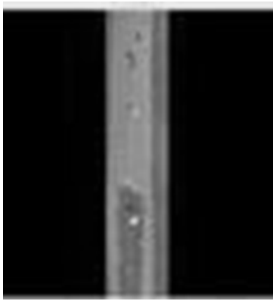

Figure 3. Containing the disease after applying the 5X5 average filters.

The image after applying the 5X5 average filter is shown in Figure 3. It can be seen that the image is less noisy but the edges are less sharp than in the original image.

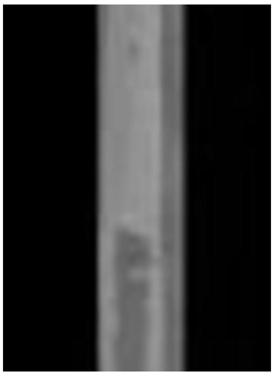

Figure 3.Containing the disease in paddy leaf after applying the adaptive average filter.

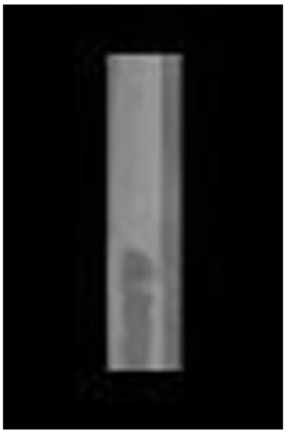

Figure 4. Containing the disease after applying the unsharp filter

IV. COMPARISION OF ADAPTIVE FILTER AND UNSHARP FILTER

The image after applying the adaptive average filter is shown Figure 3. It is visible that the noise is almost completely removed. The insect bytes and the disease are visibly separated and can be distinguished easily by a naked eye. But the edges of broken leaf are still blurry.

The image after applying the unsharp is shown in Figure 4. The edges have improved significantly and there is a sharp boundary between the broken leaves in a paddy.

V. ASF,MEDIAN, AVERAGING FILTER

However, the quality of the processed image depends on the threshold value T. Determination of optimal threshold value is, therefore, required to make the ASF having best performed. To this end, the standard deviation and slope ratio of the image are used as two criteria for measuring the performance of the ASF. To conduct the measurement of the performance, a series of composite images were generated by adding a computed –simulated like objects. In this study, the standard deviation of pixel values in a specified area, which is used to quantify the degree of noise reduction, was obtained from a region of interest in the composite images. Low standard-deviation value means that high reduction of noise can be obtained by the ASF. To investigate the extent of edge bluring, slope ratio(SR) is defined as the ratio of the profile slope of the processed image to that of the original image and can be given as

$$SR(\%)=(\Delta P_{pr} / \Delta x) / (\Delta P_{avg} / \Delta x) \text{ x100}$$

Where $(\Delta P_{pr} / \Delta x)$ *and* $(\Delta_{\arg} / \Delta x)$ image and that of the

original image. Low slope ratio value means that high edge blurring occurs resulting from the ASF.

The profile slope for the Figure 3, the processed Channel 0
Dimensions: [28, 225] (6300 elements)
Mean: 119.624
Total: 753633
Minimum: 0
at: [18, 10]
Maximum: 255
at: [10, 61]
Variance: 340.668
Standard Deviation: 18.4572
Absolute Deviation: 11.7079
Skewness: 0.564642
Kurtosis-3: 17.8957
Channel 1
Dimensions: [28, 225] (6300 elements)
Mean: 146.693
Total: 924167
Minimum: 0
at: [12, 46]
Maximum: 255
at: [16, 14]
Variance: 872.44
Standard Deviation: 29.5371
Absolute Deviation: 25.7706

Skewness: -0.0483224
Kurtosis-3: 1.16604

The profile slope for the Figure 4, the processed Channel 0
Dimensions: [28, 225] (6300 elements)
Mean: 119.355
Total: 751938
Minimum: 68
at: [22, 181]
Maximum: 175
at: [15, 220]
Variance: 197.861
Standard Deviation: 14.0663
Absolute Deviation: 10.6164
Skewness: 0.103468
Kurtosis-3: 0.719679

Channel 1
Dimensions: [28, 225] (6300 elements)
Mean: 146.828
Total: 925019
Minimum: 98
at: [4, 205]
Maximum: 212
at: [15, 220]
Variance: 741.294
Standard Deviation: 27.2267

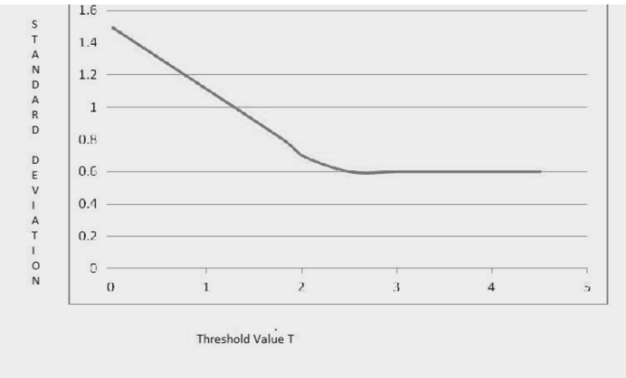

Figure 5. A plot of the SD V/S T

VI. RESULTS

The effect of thresholds value determination on the standard deviation of the image was calculated and the results are shown in the Figure 4. It is noted that the standard deviation value decreases with the increase of threshold value and is higher than 3.0. Therefore, noise reduction can be effectively achieved if the threshold value is set at T=3.0. In this case, standard deviation value of the original image is 2.3 and that of the processed image is 0.6. As a result, 76% of the noise reduction can be obtained against the original image. The variation of slope ratio with the threshold value was also investigated. The slope ratio is at approximately 60% for the threshold values ranging from 0 to 3.0 and gradually declines when the threshold value is greater than 3.0. From the two experimental results, it is reasonable to conclude that T=3.0 is the optimal value used in the ASF for image improvement in the noise reduction.

VII.CONCLUSION

In this wok the proposed adaptive smoothing filter aiming at improving the visibility and delectability of the obscuration of the infected paddy image .Moreover, in order to obtain the optimal thresholding value used in this filter. The measured standard deviation and slope ratio of the image of interest, which are respectively used to describe the degree of noise reduction and edge bluring of the images enhanced by the proposed method. The results have demonstrated that the visibility and delectability of the infected paddy image are much improved by the proposed method. The experiment is carried out using the IDL programming language. The result also showed that the proposed ASF and unsharp performed well and it is very usefully for detecting the diseases in paddy.

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