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Research paper



Comparison of various filters for noise removal in paddy leaf images

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Abstract

Automatic detection of plant diseases is one the important challenging problems in agriculture field. So the basic analyzing method for automatic identification is filtering technique of preprocessing method. Hence, this Image filtering plays a important role to remove noise from image. Consequently this preprocessing method is the initial stage to make better image quality. The purpose of this paper is comparing four types of filtering techniques to differentiate the image quality in Gaussian filter, median filter, mean filter and weiner respectively filter using common data set. The image quality of overall results shows that the comparison of various filtering technique performed to enhancement quality using hybrid technique. So this paper gives best starting for researchers to automatic detection of rice plant disease detection.

Keywords: *Rice plant, plant pathogen, brown Spot, image processing, preprocessing techniques.*

1. Introduction

Diagnosis the disease is widely used in agriculture fields using image processing. Thus, computer vision plays an important role in diagnosis plant pathology, nutrition deficiency in plant and soil testing. But in agriculture field some of the challenges are still lacking to increase productivity agr[1]. When the plants get infection, the range of the symptoms varying by shape, color and size due to environmental changes, climate condition and nutrition deficiency[2][3].

The brown spot (sesame leaf spot) is one of the most significant rice diseases in India. Brown spot is a fungal infection caused by Helminthosporiose [4]. It occurs in main field during nursery to milk stage. It appears minute brown dots later it becomes oval to circular at sever infection it cases 50% lead loss. So before going sever loss automatic prediction is needed to protect the plant from pathogen [5].

The quality of the image differs from various bases like noised image, blurred image and poor contrast image. But some of the images have serious noise occurs due to environmental changes, capturing condition etc. those noise were not adapt for further analyzing [6]. Hence, these processes to be carried out to remove noise from a signals are drawn from reduction technique. In order to get clear image noise should be removed from the input image for further analyzing. Generally images are divided into number of small pixel. Those pixel values are carried out of noise removal process. Then the noised pixel values are interchanged by using median pixel value to find original denoised pixel. So the preprocessing begins by various filtering techniques Gaussian filter, median filter, mean filter, wiener filter respectively used to reduce noise from image [7].

This paper is arranged as follows. Section I presents the Introduction of filtering technique in rice plant , Section II describes the various method discussed by researchers, Section III aims to discuss about the experimental results and in Section IV report's conclusions finally Section V with Reference.

2. Related work

[8] proposed a method to the image quality using the mathematical function of peak-signal-to-noise ratio (PSNR) and structural similarity index measure (SSIM) measured by using Kodak database. According to author, sometimes during preprocessing the quality of the image may get blurred or information may be lost. So those statistical parameters have to be calculated by PSNR and SSIM. Finally the author concluded that the parameter can be differentiating by using image degradations.

[9] aims to detect the disease in jute plant leafs Using Image Processing techniques and Machine Learning. The author focused the algorithm into two main stage: first one is image preprocessing and other one is segmentation process. The author stated that the noise in the image was removed by using bilateral filter. To remove the noise the intensity value of pixel was replaced neighbor value.

[10] proposed a method to remove the noise of image using Gaussian filter. According to author, a technique used to calculate noisy estimation is from pixel value to automatic parameter using non linear algorithm. The author concluded that priori information is does not needed for variance calculation used by this proposed algorithm. So this method shows more effective and efficient for cancelling noise in image.

The method proposed by [11] aims to rectify the image from denoised input image. The author has been compared between three types of filters such as special filter, weiner filter and median filter on noised based image. Finally the author concluded that weiner filter was better performance than remaining two filters. But using special filter the result of the image gave clarity from denoised image.

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[4] has been proposed for the removal of noise for involving inverse Laplacians. According to author, a efficient algorithm was proposed to tackle the problem of Monogenic Signal using low pass filter. Fourier transform solution used to match the pixel value. The color change according to zero crossing contours for solving zero crossing contours.

3. Materials and methods

Image Enhancement used to improve the quality of information from the noised input image. This is the basic requirement to analyze to go for next process [12]. There are number of filters available to remove noise from the image. Two major enhancement method used to improve the quality of image is Spatial Domain and Frequency Domain methods. These methods used for pixel calculation of images. But in frequency domain the Fourier Transform used to calculate the pixel from frequency domain.

Filtering methods

Input images are affected by various noise either Gaussian filter, Weiner filter etc. so noise image process is carried out to improve the image quality using the filtering techniques respectively. The detail of each noise described below.

Gaussian filter

Gaussian filter is to remove noise from de-noised input. This filter contains a input function in stepwise without overshoot, Due to this the fall time and rise time is reducing. So this action of behavior says the filter will delay with minimum possible. Mathematically, a Gaussian filtering method response the signal of input in the way of twist to drawn from a Gaussian functions. This change is called weierstrass transform. In this image processing the Gaussian function is used to blurring an image it is the result of Gaussian blur. The effect of graphics software is usually used to reduce a noise in image[10] .
The Gaussian distribution (Gx) with standard deviation (σ) for one dimension and two dimension it is represented like (x) is an image point for one dimension and (x,y) is the pixel for two dimension it is described below in two equation .

$$G(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{x^2}{2\sigma^2}}$$

This two equation will applied to the original image we will observe the change of filtering.

$$G(x,y) = \frac{1}{2\pi\sigma^2} e^{-(x^2+y^2)/(2\sigma^2)}$$

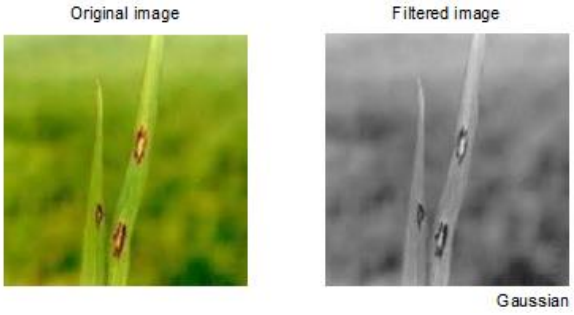


Fig. 1: (a) Input image of rice plant (b) image obtained after denoising by gaussian technique

Median filter

It is a non-linear process that is used to reduce the grey or salt and pepper noise which can protect the edge of an image during random noise reduction process. During the process a stimulus or salt and pepper noise caused by a random bit error in the broad cast channel. In a median filter along the image moved and allowed by window and intensity value of median, is across the window and become the intensity of the pixel as a output it is processed usually. The implementation of this filter is used to reduce a noise in the image [13].
The technique of filtering:

- Pixel in the queue is sorting.
- The window in number order is sorting.
- As a pixel value window is selecting the median

The inconsistent and hurried noise filter by median filter .This filter is popular to maintain edges.
The equation of transfer used here;
T(a, b)=I(m x m)/2
I1<I2<I3<…..<In
Hence,
I(m x m)/2 the value of intensity in the position of middle is used to sort the pixel in array ,When this above equation applied to original of image we will observe the change in filter.

Mean filter

The most commonly filter used to reducing noise from image is Mean filter. The matrix value taken for mean filtering is 3×3 kernel. It shows an image containing `salt and pepper & noise. It shows the effect of smoothing noisy of image with a 3×3 mean filter. The noise pixel values are very different from the surrounding values, they will calculated the pixel average by the mean filter. Mean filter calculates the amount of all pixels in the filter window and then number of pixel is divided by sum in filter window [14]. The values has been matched to denoised image using mean filter shown in Fig 2.



Fig. 2: (a) Input image of rice plant (b) image obtained after denoising by mean technique

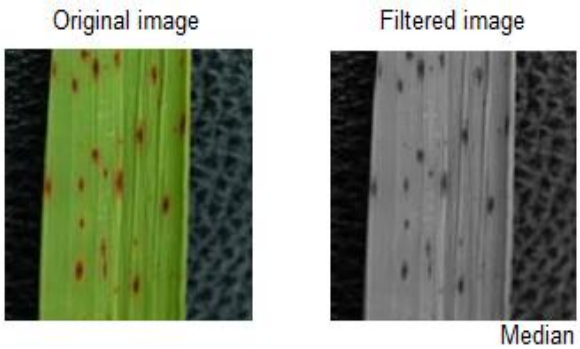


Fig. 3: (a) Input image of rice plant (b) image obtained after denoising by median technique

Wiener filter

The wiener filters aim is match the pixel to reduce the bunch of noise which was present in the image and you can compare it by evaluating the desired noise image. The main goal of the wiener filter is to filter out of the noise which was broken a signal. It approach based on statistical. Then when comparing to other filter this linear filtering method provide better result. It offers edge preservation and other segment of an image in high frequency but it have more time on computation than others. Using wiener filter

the comparison of psnr and snr values [15] has been showed fig (5). Function can be written by,

$$f(u,v) = \left[\frac{H(u,v)^*}{H(u,v)^2 + \left[\frac{Sn(u,v)}{Sf(u,v)}\right]}\right] G(u,v) \quad [11]$$

Where,

- X(m ,n) for degradation function
- y(m,n)* for conjugate complex
- z(m ,n) to calculate degraded image.
- Function X(m ,n)and z(m ,n) the noise and the original image of power separate.

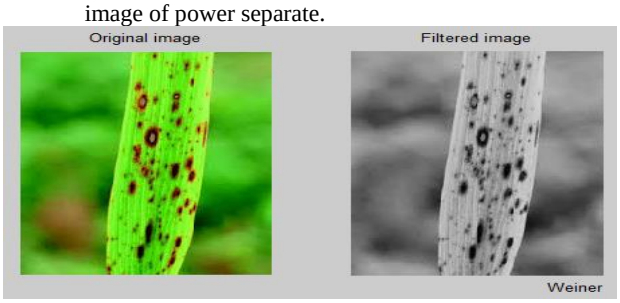


Fig. 4: (a) Input image of rice plant (b) image obtained after denoising by weiner technique

Table 1: Comparative Study of PNR obtained for Weiner Filter

Weiner Filter			
Image	Psnr	Snr	Mse
1	45.44	16.82	29.83
2	44.73	17.7	24.22
3	41.94	19.76	18.38
4	34.2	14.9	41.9
5	39.3	11.54	43.94
6	34.11	13.48	54.01
7	36.55	16.42	36.81
8	32.06	12.81	57.64
9	37.07	13.05	53.37
10	38.2	14.98	42.75

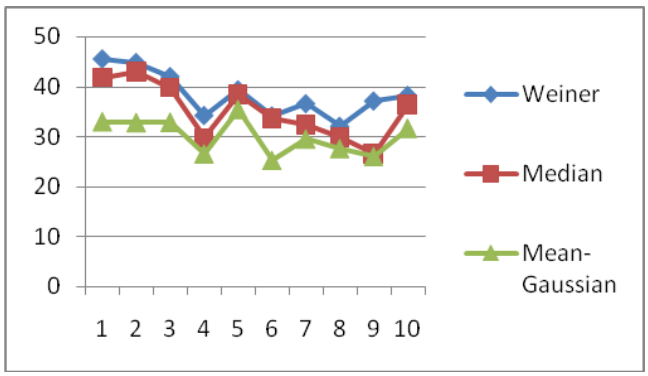


Fig. 5: Graph showing the PSNR values for various filters Techniques

4. Conclusion

Noise is one the most important preprocessing method to improve the quality of image from noised input image. Here, various filtering technique are implemented to different the type of Noise. This paper analyze and compared various filtering techniques such as Gaussian filter, Weiner Filter, Mean and Median to find the parameter values of PSNR, SNR and MSE. Through this work it observed that among all the filtering process Weiner filter has better result than all the filters of highest Peak Signal to Noise Ratio (PSNR) PSNR values and SNR values. So these methods used to preprocess brown spot disease in rice plant which helps to analyze further processing.

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