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High Density Noise Reduction of Tea Leaves using Density Mass Filter (DMF)

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Abstract: ***In agriculture digital image processing play an important role in the prediction of tea leaves diseases. But acquisition of image may be corrupted by various types of noise such as impulse noise, Gaussian noise and salt and pepper noise. These noises can corrupt the image. So it will reduce the quality of the image and it reduces the classification accuracy. Hence it needs a efficient filter to remove these noise. This paper introduced a new filter density mass filter. It reduces all kinds of noise. Two metrics PSNR (Peak Signal to Noise ratio) and RMSE (Root Mean Square Error) values are used to evaluate the quality of images. The PSNR value of proposed filter is significantly high and RMSE value is reasonably low.***

Keywords: PSNR (Peak Signal to Noise Ratio), RMSE (Root Mean Square Error), Digital Image Processing.

I. INTRODUCTION

Tea leaf production is playing vital role in the contributing to Indian economy. It is mandatory to predict the diseases that affect the plan at the earliest. Timely prediction will help in increase in the yield of the crop. To make the prediction a possible option digital images are playing an inevitable role in prediction of disease prediction and classification of diseases. Digital images processing has laid its wings in other major areas such as wild animal traffic in forest, natural resource availability, medical field etc., however, the accuracy and dependency of these systems depend on the quality of the input images. Images that are acquired may contain noises that naturally interrupt the quality of the image. Theses noises will result in effecting the quality of the image by causing damages to the pixel distribution, edge details, and produce unclear image. In order to improve the quality of the image it is essential to remove the noises that are present. Images may get affected by various noises such as speckle noise, impulse noise, Gaussian noise and fractal Noise; the foremost task of a researcher is to task of remove these noises in order to accomplish a quality image. It can be attained by implementing various techniques that are available to remove or to limit the presence of noise in the image. Selection of noise removal technique has to be done carefully without affecting the quality of the original image.

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The current paper concentrates in enhancing accuracy of the noise removal techniques without affecting or blurring the original image. It also increases the PSNR value of the filter.

II. TYPES OF FILTERS

Pre-processing is the initial step in image processing. Pre-Preprocessing of digital image includes noise removal, edge detection, image re-sizing, compressing, etc., These are chosen by the researcher based on the image and requirement of the problem definition. There are number of methods proposed on each category by the researchers' worldwide. The following are the different types of filters that are commonly used in noise removing.

A. Mean Filter:

The working factor of mean filter is to find the mean (average) and replace the pixel value of the image by its neighbor and by including itself. The pixel values that are not represented by its surrounding pixels are eliminated by the mean filter. Mean filter is also referred as Convolution filter. Calculation of mean is done based on the shape and size of the neighborhood pixel sample. The working of mean filter is around the kernel.

B. Median Filter:

The mean filter calculates the mean by considering the pixels thatare represented by the neighborhood pixels, the pixels that are not represented by the neighborhood pixelsare eliminated. Whereas the median filter in turn looks or searches for the pixel that are represented by neighborhood pixel in the image. It replaces the pixels by median value of those pixels.

C. Gaussian Filter:

The images can be pre-processed using convolution filter which at times blurs the image. Instead the image can be smoothened by applying the Gaussian filter without affecting the original image. Gaussian similar to the mean filter but the kernel chose is different from the mean filter. The kernel that is used by the Gaussian filter is 'bell-shaped' hump. It is known as Gaussian hump. The computation behind Gaussian filter is show below:

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

D. Adaptive Filtering

Adaptive filter is applicable on the images that are corrupted by noise. It is based on the M X N window region of the image. Mean and variance are used in the noise filtering technique. Adaptive filter sounds to be much better when compared to other filters due its ability to preserve the edges and other high-frequency region of the images.

E. Wiener Filter:

Weiner filter uses statistical methods to remove the noise from the image. To apply this filter one should have the spectral properties of the original image. This filter removes the mean square error of the image between the random process and desired process.

III. EXISTING METHODS

Cao, W., Wang, K., Han, G., Yao, J., &Cichocki, A (2018)[1]The author has proposed robust PCA method for applying hyper spectral image restoration process. The robustness of the image is increased by introducing an anisotropic spatial – spectral. Later an expectation-maximization algorithm is combined with alternative direction. This method has produced an optimal result.

LalitKumar,Jyoti, Mithlesh.(2018)[4]Current proposed an advanced median trimmed filter. The proposed methodology has produced an optimal result of 90% noise reduction. It is also evidenced with high PSNR value when compared with other filter. The author has als conducted various case studies by using different and same images at various noise levels rangeing from 30% to 70%. The These parameters include PSNR, MSE, and IEF. PSNR and MSE are inversely proportional to each other and if the value of PSNR would be high then the image would be considered as best.

Chithra, P. L., and Henila (2017)[3]The researcher has proposed a novel method in commotion in image. The method removes the high esteem pixel from the pixels which possess low esteem in the image. The choice of pixel is from M X N adjacent reference of the pixel.

Devi, M. R., & Kavitha, M. V. (2016)[12] proposed a Efficient hybrid filter to removing the noise in citrus fruit image. It is reducing the noise by linear and non linear filtering techniques. The reason of denoising the image is to renovate the feature of new image as greatly as possible. Simulation result also prove the efficient of ne w approach.

Sharma, S., Sharma, S., &Mehra, R(2013)[2]Proposed a new methodology in noise removal using Modified Lucy Richardson algorithm to remove Gaussian blur and motion blur. The Gaussian blur was removed with high PSNR value. Later the quality of the noise removed image is compared with the original image.

IV. PROPOSED METHODOLOGY

The new methodology consists of the following stages which involves size translation, colour transformation, noise elimination finally image enhancement.

Step 1: Acquisition of Image as given as input

Step 2: Resize the input Image

Step 3: Color Conversion RGB to Gray Scale

Step 4: Convolve this 6 X 6 matrix with a 3 X 3 filter

Step 5: Convolve over the entire image and get a 4 X 4 output

Step 6: De-noised Image

In this research image acquisition is composed of a digital camera used to obtain high quality images with a size of 3456 x 2304 pixels and a resolution of 0.03 mm/pixel. It also considers the tea leaf images are caught by camera in RGB mode with 10 mega pixels with measurements 3120x4160. Then these images resized into 256 x 256 measurements. Then Resized RGB image is converted to gray scale image. This is called as binary image. Then convolve this 6 X 6 matrix with a 3 X 3 filter. To compute the next element of the 4 X 4 output, we will move our filter single step towards the right and again get the sum of the element-wise product. This process is continued until complete entire image. The figure 1 shows the sample process of Density Mean Filter (DMF)

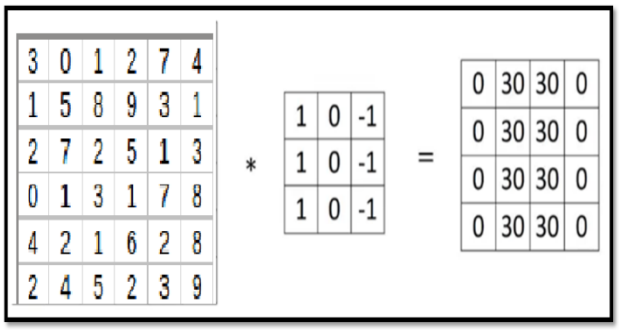

Figure 1 The sample process of Density Mean Filter (DMF)

V. RESULT AND DISCUSSION

This approach is implemented by using MATLAB and compared with existing filters such as Mean, Median. The subsequent figures be evidence for the experimental result of new filter. Figure 1 is the input image then this image is enhanced and color converted this is shown figure 2. Then 85% of salt and pepper noise commences shown in the figure 3 and figure 4 shows the result of denoised image by proposed filter.

Figure 2 Input Image

Figure 3 Color conversion and Enhanced

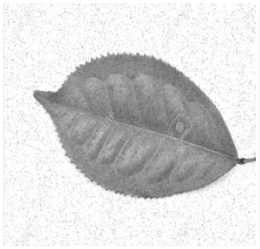

Figure 4 Speckle noise

Figure 5 Denoised by Density Mean filter

The PSNR value at different noise density is used to evaluate the quality of the image after filtering. Table 1 shows the comparison of PSNR value of existing and proposed system.

The comparison made between mean filter, Median, adaptive and Density Mass Filter. When compared with existing filters the proposed filters gave good result in the different density of noise. Table 2 shows the RMSE values of existing and proposed system. While weigh against with other system proposed system shows the lowest RMSE value.

Table . 1 PSNR value of Different Noise Density

Filter		Noise Density in db						
	15%		25%	35%	45%	55%	65%	75%	85%
Mean	68.33		69.54	70.35	72.56	75.46	77.52	78.09	79.62
Median	63.37		64.34	66.19	70.78	72.52	73.04	74.44	75.83
Adaptive	61.37		62.43	62.13	70.78	72.52	73.65	74.44	75.83
DMF	**72.34**		**73.50**	**73.55**	**73.77**	**74.64**	**80.34**	**81.23**	**84.17**

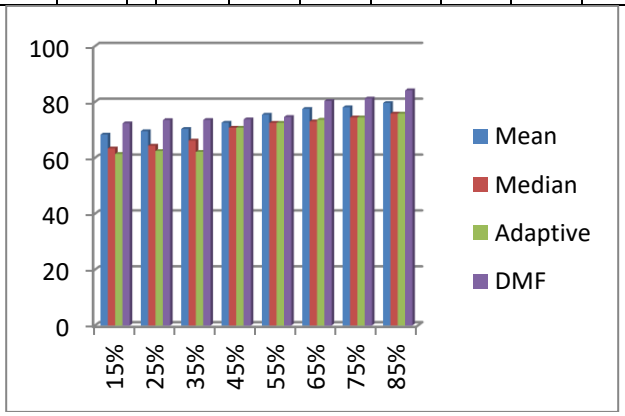

Figure 5 Comparison of PSNR values with proposed filters

Table . 2 RMSE value of Different Noise Density

Filter	Noise Density in db							
	15%		25%	35%	45%	55%	65%	75%
Mean	1.042	1.650	1.530	1.510	1.560	2.980	2.970	2.985
Median	1.110	1.208	1.200	1. 122	1.650	1.975	1.962	1.960
Adaptive	1;351	1.456	1.432	1.234	1.453	1.345	1.764	1.567
DMF	0.990	0.980	0.960	950.43	0.860	0.825	0.810	0.790

VI. CONCLUSION

Images play a vital role in prediction of disease of leaves. This research proposed a new approach to preprocessing of tea leaf image . Filters are used to decrease the noise and improve image quality. The proposed filter offered good result. The experiment result proves that new filter improve the quality of the image. To evaluate the new method two metrics PSNR and RMSE values are taken for comparison. The proposed system provide the relevant result than the other existing system.

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