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Analytical Analysis of Image Filtering Techniques

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ABSTRACT- This paper presents a survey on different image filtering techniques. Image filtering is a crucial part of vision processing as it can remove noise from noisy images. There are many filtering techniques to filter an image. Each filtering technique has its own benefits to filter an image. The overall objective of this paper is to explore the benefits and limits of existing techniques. It is found that hybrid median filter and alpha trimmed has some potential benefits over existing filters when to reduce salt and pepper noise.

Index terms: **Median filter, Alpha trimmed filter, salt and pepper noise.**

I. INTRODUCTION

Noise is any undesired information that contaminates an image. Noise appears in image from various sources. The digital image acquisition process, which converts an optical image into a continuous electrical signal that is then sampled, is primary process by which noise appears in digital image. There are several ways through which noise can be introduced into an image, depending on how the image is created. Satellite image**,** containing the noise signals and lead to a distorted image and not being able to understand and study it properly, requires the use of appropriate filters to limit or reduce much of the noise. It helps the possibility of better interpretation of the content of the image. Image noise is random (not present in the object imaged) variation of brightness or color information in images, and is usually an aspect of electronic noise. Image processing is an Electronic Domain in which image is divided into small unit called pixel and subsequently various operation has been carried out. Noise can be usually originated in the sensor or transmission channel during the acquisition and transfer procedure for the digital signal images. In the Digital Image Processing field, Enhancement and removing the noise from the image is the critical issue. Gaussian noise(white noise),Salt & Pepper noise and Speckle Noise are also restoring them with the help of several efficient technique is main concern. Noise when get added to image destroy the details of it. So in order to preserve the real image. Noise should get removed from it. And for the purpose of enhancement the contrast of the image should be improved. Image filtering these days, has become an active research area in the field of image processing. Although several research has undertaken in number of different fields. Today's world is globe of internet in which information is necessary to be exchanged across this globe, within fraction of second. This information may be composed of text, videos, or images while transmissions over the communication media are get corrupted due to addition of noise. In colour cameras where more amplification is used in the blue colour channel than in the green or red channel.

A. Gaussian noise

Additive noise is one of the most common problems in image processing. Even a high resolution photo is bound to have some noise in it. For a high-resolution photo a simple box blur may be sufficient, because even a tiny features like eyelashes or cloth texture will be represented by a large group of pixels.The standard model of amplifier noise is additive, Gaussian; independent at each pixel and independent of the signal intensity, Amplifier noise is a major part of the "read noise" of an image sensor, that is, of the constant noise level in dark areas of the image. In color cameras where more amplification is used in the blue colour channel than in the green or red channel, there can be more noise in the blue channel.

B. Salt & Pepper Noise

Salt and pepper noise is a form of noise typically seen on images. It represents itself as randomly occurring white and black pixels. An effective noise reduction method for this type of noise involves the usage of a median filter. Salt and "impulsive" noise is sometimes called salt-and-pepper noise or spike noise. An image containing salt-and-pepper noise will have dark pixels in bright regions and bright pixels in dark regions. This type of noise can be caused by analog-to-digital converter errors, bit errors in transmission, etc. Here, the noise is caused by errors in the data transmission. The corrupted pixels are either set to the maximum value (which looks like snow in the image) or have single bits flipped over. In some cases, single pixels are set alternatively to zero or to the maximum value, giving the image a `salt and pepper' like appearance. Unaffected pixels always remain unchanged. The noise is usually quantified by the percentage of pixels which are corrupted.

C. Speckle Noise

The speckle noise is commonly found in the ultrasound medical images. It is a granular noise that inherently exists in and degrades the quality of the Active Radar and Synthetic Aperture Radar (SAR) images. Speckle noise in conventional radar results from random fluctuations in the return signal from an object that is no bigger than a single image processing element. It increases the mean grey level of a local area. Speckle noise in SAR is generally more serious, causing difficulties for image interpretation. It is caused by coherent

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processing of backscattered signals from multiple distributed targets. Speckle noise is caused by signals from elementary scatterers, the gravity-capillary ripples, and manifests as a pedestal image, beneath the image of the sea waves.

II. LITERATURE REVIEW

Changhongwang et al. (2010) [1] has proposed a novel improved median filter algorithm for the images highly corrupted with salt-and-pepper noise. Firstly all the pixels are classified into signal pixels and noisy pixels by using the Max-Min noise detector. The noisy pixels are then separated into three classes, which are low-density, moderate-density, and high-density noises, based on the local statistic information. Finally the weighted 8-neighborhood similarity function filter, the 5×5 median filter and the 4-neighborhood mean filter are adopted to remove the noises for the low, moderate and high level cases, respectively. The validation results show that the proposed algorithm has better performance for capabilities of noise removal, adaptively, and detail preservation, especially effective for the cases when the images are extremely highly corrupted. Yong Wang et al. (2012) [2] has done the comparative study of research work done in the field of image filtering. Image filtering processes are applied on images to remove the different types of noise that are either present in the image during capturing or introduced into the image during transmission. The salt & pepper(impulse) noise is the one type of noise which is occurred during transmission of the images or due to bit errors or dead pixels in the image contents. The images are blurred due to object movement or camera displacement when we capture the image. This pepper deals with removing the impulse noise and blurredness simultaneously from the images. The hybrid filter is a combination of wiener filter and median filter. Abihesk Tripathi et al. (2012) [3] has been proposed for the removal of fog using bilateral filter. In this paper, a novel and efficient fog removal algorithm is proposed. Fog formation is due to attenuation and air light. Attenuation reduces the contrast and air light increases the whiteness in the scene. Proposed algorithm uses bilateral filter for the estimation of air light and recover scene contrast.. Proposed algorithm is independent of the density of fog and does not require user intervention. It can handle colour as well as gray images. Proposed algorithm has a wide application in tracking and navigation, consumer electronics and entertainment industries. V.D. Ebenezer et.al (2009) [4] in paper "A impulse noise removal method in images using modified trimmed median filter" has proposed a novel decision based trimmed median filter algorithm for restoring gray scale, and colour images of highly corrupted. It interchanges the noisy pixel by trimmed median pixel value when other values of pixels, 0's and 255's are present in the selected window and when all the pixel values are 0's and 255's then the noise pixel is replaced by mean value of all the elements present in the selected window. It can handle colour as well as gray images. Rongzhu et al. (2012) [5] has demonstrate the application of improved median filter on image processing. Median filter is the most common method of clearing image noise. This paper proposes improved algorithm of median filter to remove sale and pepper noise of image. According to the characteristics of salt and pepper noise, the algorithm detects image noise, and establishes noise marked matrix, without processing the pixels marked as signal. The signal of the pixel is marked as not treated, labelled according to their pixel noise pollution in the neighbourhood to take a different pixel weighted mean filter window size, weight pixel region by the noise points to determine the local histogram. Matlab experiments show that improved median filter can greatly reduce the time of clears image noise and it performs better than median filters on noise reduction while retaining edges of an image. Peng, Shaomin et al.(1995) [6] has been proposed a work on image enhancement using α-trimmed mean filters. Image enhancement is the most important challenging pre-processing for almost all applications of Image Processing. By now, various methods such as Median filter, α-trimmed mean filter, etc. have been suggested. It was proved that the α-trimmed mean filter is the modification of median and mean filters. On the other hand, filters have shown excellent performance in suppressing noise. In spite of their simplicity, they achieve good results. In this paper, we suggested a new filter which utilizes α-trimmed mean. We argue that this new method gives better outcomes compared to previous ones and the experimental results confirmed this claim.

III. LIMITATIONS OF EXISTING WORK

It has been found that in existing technique -

1) Salt& Pepper Noise only- In [1] paper only 'Salt & Pepper' noise is removed, other type of noises are not considered. Less effective in removing Gaussian or random-intensity noise.

2) Low frequency Images- The [1] paper has not focused on low frequency images. Fails to remove the noise to low frequency area.

3) Fog/dust Removal

IV. HYBRID FILTER

The basic problem in image processing is the image enhancement and the restoration in the noisy environment. If we want to enhance the quality of images, we can use various filtering techniques which are available in image processing. There are various filters which can remove the noise from images and preserve image details and enhance the quality of image. Hybrid filters are used to remove either Gaussian or impulsive noise from the image. These include the median filter and wiener filters. Combination or hybrid filters have been proposed to remove mixed type of noise during image processing from images. This hybrid filter is the combination of Median and wiener filter. when we arrange these filter in

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series we get the desired output. First we remove the impulse noise and then pass the result to the wiener filter. The wiener filter removes the blurredness and the additive white noise from the image. The result is not the same as the original image, but it is almost same.

V. MEDIAN FILTER

Median filtering is a common image enhancement technique for removing salt and pepper noise. Because this filtering is less sensitive than linear techniques to extreme changes in pixel values, it can remove salt and pepper noise without significantly reducing the sharpness of an image. In this topic, you use the Median Filter block to remove salt and pepper noise from an intensity image. Median filtering is a nonlinear operation used in image processing to reduce "salt and pepper" noise. Also Mean filter is used to remove the impulse noise. Mean filter replaces the mean of the pixels values but it does not preserve image details. Some details are removes with the mean filter. But in the median filter, we do not replace the pixel value with the mean of neighbouring pixel values, we replaces with the median of those values. The median is calculated by first sorting all the pixel values from the surrounding neighbourhood into numerical order and then replacing the pixel being considered with the middle pixel value. (If the neighbouring pixel which is to be considered contains an even number of pixels, than the average of the two middle pixel values is used.Fig.1 illustrates an example calculation. Fig.1:Exp. of median filtering. The median filter gives best result when the impulse noise percentage is less than 0.1%. When the quantity of impulse noise is increased the median filter not gives best result.

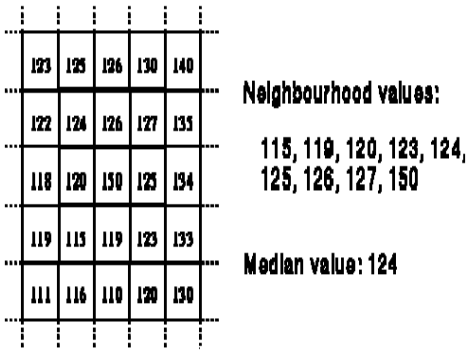

Fig.1 illustrates median filter

VI. A-TRIMMED MEAN FILTER

In order to calculate the α-trimmed mean, the data should be sorted low to high and summed the central part of the ordered array. The number of data values which are dropped from the average is controlled by the trimming parameter α which on the other side of the coin, we already know that the moving average filter suppresses additive white Gaussian noise better than the median filter, while the median filter is better at preserving edges and rejecting impulses . The best choice taking advantages of both moving average and median filter was proposed called the a-trimmed mean filter. The α-trimmed mean filter rejects the smaller and the larger observation data depending on the value of α.

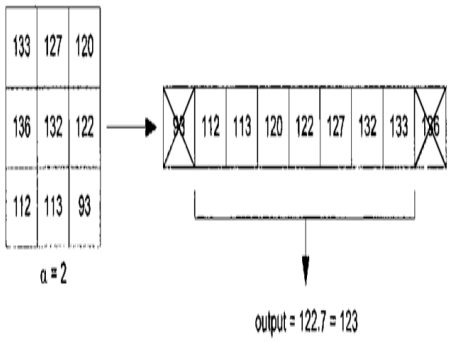

Fig. 2 Alpha-trimmed mean filter, for the case of an example 3×3 neighbourhood and a=2.

Due to these drawbacks, this dissertation proposed a noble technique which will use improved median filter that gives better performance in restoring images than its existing techniques. In order to performance comparison, different metrics of images and complexity theory will be considered. An appropriate comparison will be drawn among proposed technique and previous well known techniques. We already know that the moving average filter suppresses additive white Gaussian noise better than the median filter, while the median filter is better at preserving edges and rejecting impulses

VII. CONCLUSION

By conducting the review of some high quality papers it is found that the hybrid median filter has quite more benefits over existing image filters. It is also found that hybrid median filter is only best for salt and pepper noise. To remove other kind of noises like Gaussian and random noise some other filters are required. So to make the filtering more better a new filter will be proposed in near future which has ability to remove more than one type of noises.

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