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Proportional analysis of Different Types of Image Noise and Competent Noise Subtraction Techniques

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ABSTRACT: Researchers finds it difficult to analyse images with noise, so in this paper an inventive method for removing noise from the images is found, before dealing out them for further analysis. Noise can corrupt the image at the time of transmission of the image. Noise elimination from the image is done at greater precedence, before applying image processing tools to an image. Noise removal algorithm depends on the type of noise present in the image. In this paper, some important type of noise and a comparative analysis of noise removal techniques are done. This paper investigates the results of applying various noise reduction technique and PSNR value for the images are found.

KEYWORDS*:* Salt & Pepper noise, Gaussian noise, Poisson Noise, Speckle Noise.

I. INTRODUCTION

Noise is a random variation of image Intensity and visible as grains in the image. It may be created at the time of image transmission. Noise means, the true pixel value in an image show different intensity. Smoothing the entire image by leaving areas near contrast boundaries will reduce the visibility of noise in the image. Different types of noises are a) Impulse noise, b) Additive noise, c) Multiplicative noise.

Fig:1 original Image

Fig:2 Gray Scale image

II. DIFFERENT TYPES OF NOISE

Noise is the unwanted effects produced in the image. During image acquisition or transmission, numerous factors are responsible for introducing noise in the image. Depending on the type of disorder, the noise can change the image to different extent. Usually our focus is to eliminate certain kind of noise. So different algorithms are applied to remove the identified noise. Image noise can be classified as Salt-and-pepper noise, Gaussian noise, Poisson, Speckle noise.

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Fig:3 salt & pepper noise with noise ratio 0.2

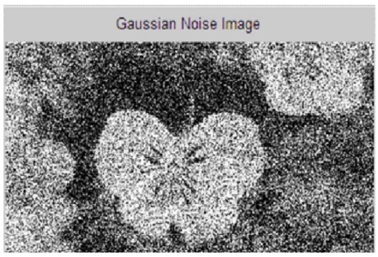

Fig:4 Gaussian noise with noise ratio 0.2

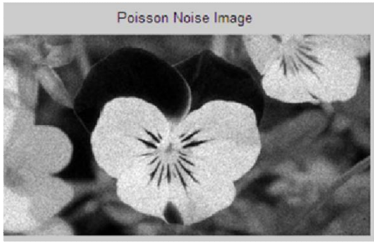

Fig:5 Poisson noise image with default noise ratio

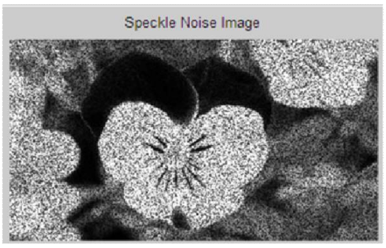

Fig:6 Speckle noise image with noise ratio 0.2

A. SALT AND PEPPER NOISE

Salt and pepper noise will have black and white dots in the image. Sharp and sudden change in the image causes salt and pepper noise. This type of noises is caused because of faulty overheated components or Dust particles in the image. (Fig: 1)Show the effect of this noise on the original image. Observe that the max (salt) and min (pepper) values are 255 and 0 respectively. We need to add white and black pixels randomly in the image matrix, random values for the matrix is generated with range 0 to 10,pixels with 0 value is replaced with black color and pixels with 255 value is replaced with white.

B. POISSON NOISE

Poisson noise is caused, when the sensed photons is not sufficient to give a statistical information [9]. The square root intensity of the image is proportional to the square mean value of the noise. Different pixels are suffered by independent noise values. Fig: 5 show the result of adding Poisson noise.Instead of adding artificial noise we are using K= imnoise(J,'poisson') to generate Poisson noise from the data. Where J is double precision.

C. GAUSSIAN NOISE

This noise follows Gaussian distribution [3]. Implicating that sum of the true pixel value is equal to each pixel in the noisy image. The noise is independent of intensity of pixel value at each point.
Gaussian white noise of mean ma and variance va to the image
K1 = imnoise(J1,'gaussian',ma,va) adds J1. The default is zero mean noise with 0.2 variance.

D. SPECKLE NOISE

This noise is created by multiplying random value to the pixel values of the image
To generate speckle noise multiplicative noise is added to the image J2 ,
K2 = imnoise(J2,'speckle',v), using the equation
$k = x + n*x$
k-speckle noise distributed image
n-uniform noise image with mean 0 and variance v here v's value is 0.2
x-input image.

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III. IMAGE DE-NOISING

Image de-noising is extremely significant work in image processing for the scrutiny of images. Ample image de-noising algorithms are accessible, but the finest one should eliminate the noise completely from the image, while preserving the details. De-noising method can be linear as well as non-linear. Where linear methods are fast enough, but they do not preserve the particulars of the images, while the non- linear methods preserve the details of the images. Broadly speaking, De-noising filters can be categorized as follows:

- Order Statistics filter
- Averaging filter
- Adaptive filter

A. MEDIAN FILTER

Median filter is the most excellent order static, non- linear filter, whose response is based on the ranking of pixel values limited in the filter region. The fairly accepted filter for reducing definite types of noise is median filter, where the middle value of the pixel is replaced by means of the median of the pixel values under the filter region [9] [10]. Fig 9-Fig 12 illustrates the outcome of median filter on diverse types of noise. Median filter is excellent for salt and pepper noise. These filters are extensively used as smoothers for image processing, plus in signal processing. A main benefit of the median filter other than linear filters is that the median filter can eradicate the outcome of input noise values with exceedingly huge magnitudes.

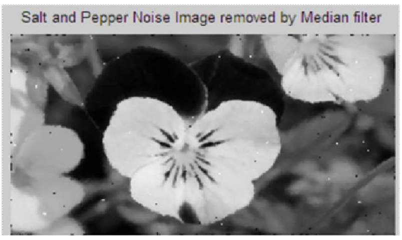

Fig:7 Salt& Pepper noise image with median filter

Fig:8 Gaussian noise image with median filter

Fig:9 Poisson noise image with median filter

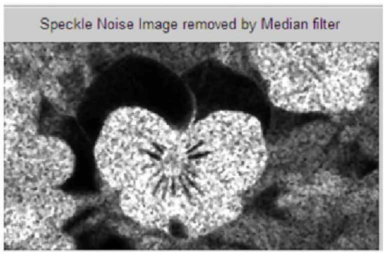

Fig:10 Speckle noise image with median filter

B. MEAN FILTER

Mean filter is an averaging linear filter [6]. This filter computes the average value of the corrupted image in a pre-decided region. Then the centre pixel intensity value is replaced by that average value. This process is repeated for all pixel values in the image. Fig 11-Fig 14, show the effect of using mean filter of size 5X5 on different types of noise.

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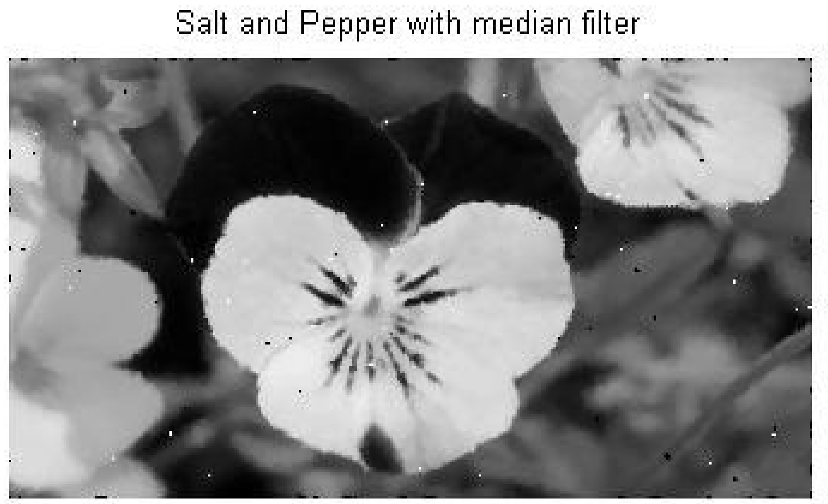

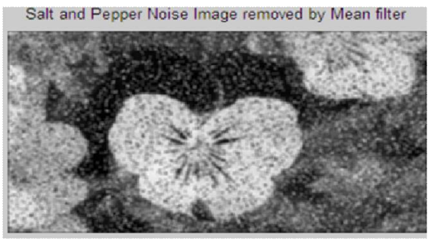

Fig:11 Salt &Pepper noised image with mean filter

Fig:12 Gaussian noised image with mean filter

Fig:13 Poisson noised image with mean filter

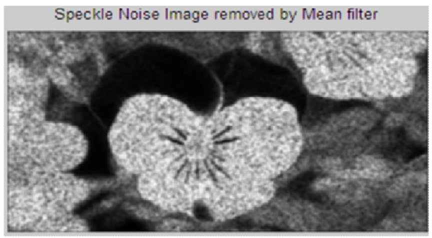

Fig:14Speckle noised image with mean filter

C. ORDER STATISTICS FILTER

Non-linear filters like Order-Statistics filter whose response is based on the ordering of pixels amid the filter area. If the centre value of the pixel in the image region is replaced by 100th percentile, the filter is called max-filter. Alternatively, if the same pixel value is replaced by 0th percentile, the filter is termed as minimum filter. Fig. 15-Fig 18 will present the result of using minimum order Statistics filter

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Fig:15 Salt and Pepper noised image with order static filter

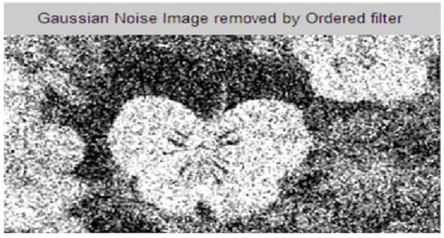

Fig:16 Gaussian noised image with order static filter

Fig:17 Poisson noised image with order static filter

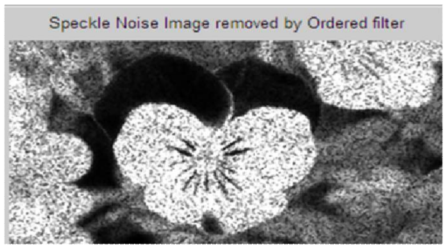

Fig:18 Speckle noised image with order static filter

D. WIENER FILTER

Wiener filter is a filter used to produce an approximate of a preferred or target random process by linear time-invariant (LTI) filtering of an realistic noisy process, presumptuous recognized stationary signal and noise spectra, and additive noise. The mean square error between the estimated random process and the preferred process is reduced by wiener filter .the most significant method for removal of blur in images due to linear motion or distorted optics is Wiener filter. From a signal processing perspective, blurring due to linear motion in a photograph is the result of poor sampling. every pixel in a digital manifestation of the photograph must represent the intensity of a single stationary point before the camera. But, if the speed of the shutter is too slow and the camera is in motion, a specified pixel will be an amalgam of intensities from position along the line of the camera's motion.

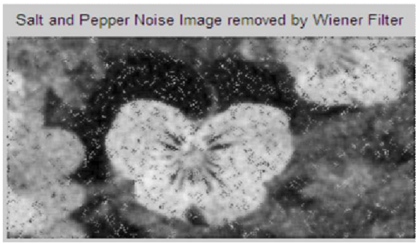

Fig:19 Salt &Pepper noised image with Wiener Filter

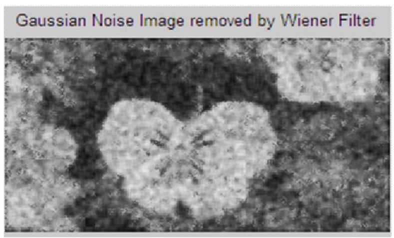

Fig:20 Gaussian noised image with Wiener Filter

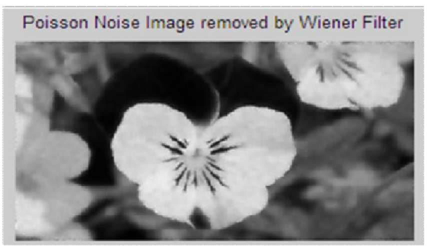

Fig:21 Poisson noised image filter with wiener filter

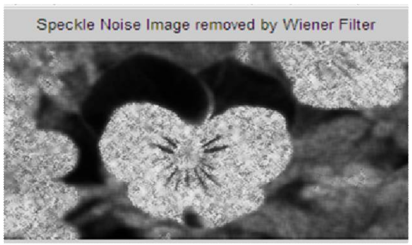

Fig:22 Speckle noised image with wiener filter

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IV. RESULTS

TABLE 1. PSNR Value for different filtered image

Filters\Noises	Salt & Pepper	Gaussian	Poisson	Speckle
Mean	14.6559	14.3141	17.7174	14.426
Median	19.4628	14.0912	18.0183	14.516
Order Static	19.6381	15.0766	18.1999	15.458
Wiener	14.7767	14.2942	18.0938	14.830

The Peak signal-to-noise ratio for salt and pepper noise measured using Order static is 19.6381 . Median filter gives the second best result. So, for Salt and Pepper noise, Median and Order static filters give a satisfactory PSNR value. For Gaussian noise, Order static and Mean filter gives a decent PSNR values 15.0766 and 14.3141 respectively. For Poisson noise, Order static and Wiener filters give higher PSNR values 18.1999 and 18.0938 respectively. Finally, for Speckle noise, Order static and Wiener filter works better. Thus, Order Static Filtering techniques give a higher PSNR value for all noises (Salt&Pepper-19.6381, Gaussian-15.0766, Poisson-18.1999, Speckle-15.458) compared to other technique

V. CONCLUSION

In this paper different types of noises and various filtering techniques are discussed. To find which filter works best, PSNR value is found for each filtered image, higher the PSNR value the better .In the above experiment order static filter is getting the higher PSNR value compared to other filters. Thus we conclude order static filters perform well for all the noised images.

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