**Noise Removal in image processing**

#### A Project Report Submitted in partial fulfillment of the requirements for the award of the degree of

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##### BONAFIDE CERTIFICATE

This is to certify that the project titled **Noise Removal in image processing**

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**ABSTRACT**

Image denoising is to remove noise from a noisy image, so as to restore the true image. However, since noise, edge, and texture are high frequency components, it is difficult to distinguish them in the process of denoising and the denoised images could inevitably lose some details. Image denoising is the technique of removing noise or distortions from an image. Noise is a random variation of brightness or color information in images and an undesirable by-product of image that obscures the desired information. We are removing speckle noise using wiener filter and Gaussian noise using Gaussian filter.

Keywords: image denoising , gaussian filter , gaussian noise , speckle noise , wiener filter.

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1. **Introduction**

Noise removal algorithm is the process of removing or reducing the noise from the image. The noise removal algorithms reduce or remove the visibility of noise by smoothing the entire image leaving areas near contrast boundaries. But these methods can obscure fine, low contrast details Noise is caused due to various sources which include many external causes in transmission system and environmental factors which includes noise like Gaussian, Poisson , Blurred , Speckle and salt-and-pepper noise. Noise removing method has become an important factor in medical imaging applications and the most commonly used filters are Median filter, Gaussian filter, Weiner filter which gives the best result for the respective noises.

The need for the smoothening of images has becomes essential which is required to remove the noise and for that best filters or standard filters are used in most of the image processing applications. The important asset of a good image de-noising model is to remove the noise from the image and also preserve the edges. There are two types of models which are used for de-noising i.e. linear model and non-liner model and generally, linear models are used because of its speed and limitation is that it is not able to preserve the edges in an efficient manner.

These data is observed by using filters and finding out the best filter on the basis of the histogram, size and clarity of the MRI images given to these filters.

**1.1 Image Restoration**

The process which attempt to remove the noise from the image and restore the quality of the original image is known as Image Restoration. This is an important aspect in maintaining the quality of the image by restoring the pixel value. Restoration techniques are a model for linear image degradation and it is the opposite process to improve the quality of original image. To obtain an optimal estimate of the desired result restoration technique involves mathematically principle of goodness which helps to achieve.

**1.2 Noise Removal Techniques**

Image de-noising is an important image processing which includes both process itself and as a component in other process. There are many ways to de-noise an image. It is solved by using different algorithms. Accordingly, noises are spotted with neighboring information and are removed using best filtering techniques without affecting the image quality and reinforce the smoothness of the image taken for examination.

**Median Filter**

The Median filter is the popular known order-statistic filter in digital image processing. Median filter is very popular technique for the removal of impulse noise because of its good de-noising power and mathematical accuracy. The value of a pixel is replaced by a median of the intensity levels in the neighborhood of that pixel by the Median Filter. A fixed filtering window size is used for outcome of neighborhood pixels by the Median Filter. The median filters are implemented consistently across the image and therefore tends to modify both noisy and noise free pixels present in the image. Relation to this, there is always a chance of replacement of good pixels by some corrupted ones. Therefore, de-noising is often accomplished at the expense of blurred and distorted features thus removing fine details present in the image.

**Weiner Filter (WF)**

The goal of the Weiner filter is to remove the noise or filter out the noise that has corrupted a signal. This filtering technique is based on a statistical approach to filter the noise. Typical filters are designed for a wanted frequency response and Weiner filter is the good example for this kind of approach. This filtering technique approaches filtering from a different angle. Before starting with this technique one should have the knowledge of the spectral properties of the original signal and the noise present in the image, one seeks the LTI filter (Linearity and Time-Invariance) whose outcome will be closer to the original signal present in the image as achievable.

Wiener filter is a technique which performs optimal trading between inverse filtering and noise smoothing. It removes the blurring and additive noise present in the image and it is also very optimal in relation to the mean squared error where it minimizes the overall Mean Square Error in the operation of the filtering technique for noise removal [1].

**Wiener filters are usually defined and characterized by the following**

a. Hypothesis: signal and additive noise are inactive linear random processes with known spectral characteristics.

b. Necessity: The filter must be physically reachable and can be accessed.

c. Performance criteria: It depends on minimum Mean Square Error.

**Gaussian filter**

Speckle Noise is typical noises which is caused due to internal or external factor and are generally present in the digital images and MRI images. Gaussian filter is implemented to remove the Speckle Noise present in ultra sound images or MRI brain images. In this technique, the average value of the surrounding pixel or neighboring pixels replaces the noisy pixel present in the image which is based on Gaussian distribution.

**Gaussian Noise**

Gaussian distribution which is also known as normal distribution whose Probability Density Function is equal to statistical noise known as Gaussian Noise. This noise is removed from the digital images by smoothening of the image pixels which helps in reducing the intensity of the noise present in the image which is caused due to acquisition but the result maybe sometime undesirable and also which can result in blurring edges of the high-quality images [2].

The formula of adding the Gaussian Noise to an image is:

g = imnoise (I, ‘gaussain’, m, var), where I is the input image, m is mean and var is variance.

**Salt Pepper Noise**

The image which is low in quality has bright and dark pixels present in it which causes noise in it also referred as Salt Pepper noise. An image which contains Salt Pepper noise will generally have bright pixels in dark portion and dark pixels in bright portion of the image. Black and white dots appear in the image [3] as a result of this noise shown in the fig 10(a).

 Due to sharp and unexpected changes of image signal the noise arises. Dead pixels, analog-to-digital converter errors, bit errors in transmission, etc. are caused due to the presence of Salt Pepper noise in the image. This kind of noise can be removed by using Dark Frame Subtraction (DFS) and by constructing new data points around dark and bright pixels which is obtained by the Median filter or morphological filter [4].

**Speckle Noise**

The Speckle Noise is defined as a noise which is present in the images and which degrades the quality of an image. Speckle Noise is a phenomenon that convoys all coherent imaging modal quality in which images are produced by interfering echoes of a transmitted waveform that originate from diversity of the studied objects [5].These are the granular noises that are fundamentally present in the image and reduce the quality of the active radar and Synthetic Aperture Radar (SAR) images or Magnetic Resonance [6].

Imaging (MRI) images is referred to as Speckle Noise. If Speckle Noise is present in the conventional radar results from random variations in the return signal from an object which is no longer image process signal increases the mean grey level in an image. A Speckle Noise is the coherent imaging of objects in the image. In fact, it is caused due to errors in data transmission. This kind of noise affects the ultrasound images and MRI images.

Speckle Noise follows a gamma distribution and is given as:

(g) = [∝−1 (∝−1)! ∝ e−]

Where, ∝ is the shape parameter of gamma distribution, ‘a’ is the variance and ‘g’ is the gray level.

**Poisson Noise**

Poisson Noise is a electronic noise that occurs in an image when the limited number of particles that carry energy, such as electrons in an electronic circuit or photons in photosensitive device, is small enough to give rise to detectable statistical variations in a measurement. Consider light a stream of discrete photons coming out of a source and hitting a point which creates a visible spot, the physical process which governs the light emission are such that those photos which are emitted from the light source hits the point many times but to create visible spot billions of photons are needed. However, if the source is not able to emit handful number of photons which hits the point every second then this noise is caused.

The formula of adding the Gaussian Noise to an image is:

J = imnoise (I,’poisson’) where I is double precision, then input pixel values are interpreted as means of Poisson distributions.

**Blurred Noise**

Blurred Noise is caused due to the light intensity and external factors. Capturing reasonable photos under low light conditions using a hand-held camera can be annoying experience. Often the photos taken are blurred or noisy. These kind of images containing hazy and blurred pixels are referred to as Blurred Noise which is present in the image.

**2. Project Motivation**:

Denoising is as but a general, dynamic and unsolved bother in photo getting ready which influences the quite a lot of needless stage laptop imaginative and prescient commitments like photo division, notoriety, and looking at et cetera. The straightforward expectation of denoising is to evaluate the actual flag from the boisterous perceptions while defending the main documents which joins edges and surfaces. There's probably a alternate off among the many clamor markdown and retaining up the major snapshot information. A large arrangement of photograph denoising programs were proposed to handle the denoising limitation, nevertheless there might be however prerequisite of trade inside the calculations to give a boost to the execution of the calculations. In bleeding side years, the fix headquartered surely wholly snapshot denoising calculations like Non-nearby way (NLM) have drawn a decent purchase extra outstanding consideration involving adapt to the denoising bother. This paper elements the more than a few issues of NLM calculation and presents an assessment of vast commitments via procedure for procedure for the special creators to increase the general execution of NLM photo denoising set of controls.

**2.1 NOISES IN pix:**

Snapshot commotion is irregular (certainly not once more blessing within the thing imaged) type of brilliance or shading records in previews, and is normally a factor of electronic clamor. It maybe created by means of the sensor and hardware of a scanner or digital computerized camera. Photograph clamor likewise can in movie grain and inside the unavoidable shot commotion of an distinctive photon locator. Photo clamor is an undesirable spinoff of picture clutch that entails spurious and superfluous certainties.

The first that ways for "clamor" stepped forward toward fitting and stays "undesirable signal"; undesirable electrical vacillations in markers obtained with the aid of procedure for AM radios accelerated equipped of being heard acoustic commotion ("static"). By relationship undesirable electric changes themselves arrived to be often called "noise".[1] photograph clamor seems to be, definitely, inaudible.[2]

The estimation of image commotion can run from almost impalpable spots on a digital picture taken in exact mellow, to optical and radio cosmic pix which could also be absolutely clamor, from which a little amount of knowledge can also be inferred by using innovative preparing (a commotion arrange that may be thoroughly unsuitable in a picture given that it may be problematic to make a decision even what the trouble transformed into).

**2.2 Types of Noise Models:**

**Gaussian noise:**

Primary assets of Gaussian clamour in computerized previews rise up subsequently of acquiring e.G. Sensor commotion because of awful brightening and additionally excessive temperature, or possibly transmission e.G. Electronic circuit noise.[3] A conventional mannequin of picture clamor is Gaussian, added substance, self reliant at every pixel, and free of the sign power, expedited most commonly by using utilising Johnson– Nyquist commotion (heat clamor), which contain what originates from the reset commotion of capacitors ("kTC noise").[4]

Amplifier commotion is a boss a section of the "analyze clamor" of a image sensor, that is, of the constant clamor degree in stupid locales of the photograph.[5] In tinge cameras the place additional enhancement is utilized as a part of the blue shading channel than throughout the inexperienced or purple channel, there probably further commotion in the blue channel.[6] At higher exposures, but, picture sensor clamor is commanded with the consultant of shot commotion, which isn't Gaussian and now not impartial of signal profundity.

**Salt-and-pepper noise:**

*Main article:*[Salt and pepper noise](https://en.wikipedia.org/wiki/Salt_and_pepper_noise)

[](https://en.wikipedia.org/wiki/File:Noise_salt_and_pepper.png)

FIG:1Image with salt and pepper noise

Fat-tail disbursed or "impulsive" noise is mostly called salt-and-pepper noise or spike noise.[7] An photograph containing salt-and-pepper noise can have darkish pixels in bright regions and shiny pixels in dark areas.[8] This sort of noise can be induced by means of analog-to-digital converter mistakes, bit error in transmission, and so on.[9][10] it may be typically eliminated by utilizing darkish frame subtraction, median filtering and interpolating round darkish/bright pixels. Lifeless pixels in an liquid crystal display monitor produce a similar, however non-random, show.

**Shot noise:**

The dominant noise in the darker elements of an photo from an image sensor is by and large that precipitated by means of statistical quantum fluctuations, that's, variation in the number of photons sensed at a given publicity degree. This noise is known as photon shot noise. Shot noise has a root-mean-square value proportional to the square root of the photograph depth, and the noises at different pixels are independent of one an additional. Shot noise follows a Poisson distribution, which except at very low intensity phases approximates a Gaussian distribution.

Additionally to photon shot noise, there can be further shot noise from the darkish leakage present within the image sensor; this noise is usually known as "dark shot noise"or "darkish-current shot noise". darkish present is finest at "scorching pixels" within the picture sensor. The variable darkish cost of natural and hot pixels may also be subtracted off (utilizing "dark body subtraction"), leaving simplest the shot noise, or random factor, of the leakage. If darkish-body subtraction isn't finished, or if the publicity time is lengthy enough that the scorching pixel cost exceeds the linear cost capability, the noise will be more than just shot noise, and scorching pixels show up as salt-and-pepper noise.

**Quantization noise (uniform noise):**

The noise caused through quantizing the pixels of a sensed snapshot to a number of discrete stages is referred to as quantization noise. It has an approximately uniform distribution. Although it can be sign dependent, it's going to be signal independent if different noise sources are gigantic sufficient to cause dithering, or if dithering is explicitly utilized.

**Periodic noise:**

A usual supply of periodic noise in an picture is from electrical or electromechanical interference for the duration of the picture shooting system. An picture plagued by periodic noise will look like a repeating pattern has been added on high of the fashioned image. In the frequency area this form of noise can be seen as discrete. Enormous discount of this noise will also be performed via applying notch filters in the frequency area. the following photos illustrate an snapshot plagued by periodic noise, and the outcome of reducing the noise utilising frequency area filtering. Be aware that the filtered image nonetheless has some noise on the borders.

Extra filtering would reduce this border noise, nevertheless it might also lessen probably the most satisfactory small print within the photo. The exchange-off between noise reduction and maintaining fine important points is software precise. For example if the first-class small print on the citadel should not regarded primary, further low move filtering might be an suitable alternative. If the satisfactory important points of the fort are considered most important, a workable solution could also be to crop off the border of the image completely.

|  |  |
| --- | --- |
| [Description: https://upload.wikimedia.org/wikipedia/commons/thumb/c/c9/Noisy_Smithsonian_Castle.jpg/220px-Noisy_Smithsonian_Castle.jpg](https://en.wikipedia.org/wiki/File:Noisy_Smithsonian_Castle.jpg)  FIG:2An image injected with periodic noise. | [Description: https://upload.wikimedia.org/wikipedia/commons/thumb/2/2c/Filtered_Smithsonian_Castle.jpg/220px-Filtered_Smithsonian_Castle.jpg](https://en.wikipedia.org/wiki/File:Filtered_Smithsonian_Castle.jpg)  Application of frequency domain notch filters. |

Gaussian commotion is factual clamor having an open door thickness work (PDF) equal to that of the conventional dispersion, which is in a similar fashion known as the Gaussian distribution. In quite a lot of expressions, the qualities that the commotion can manage are Gaussian-distributed. The open door thickness work p of a Gaussian irregular variable z is given by:where z speaks to the dim stage, "mu" the suggest cost and sigma a an identical historic deviation.

A specified case is white Gaussian commotion, where the traits at any suit occurrences are indistinguishably allotted and factually fair (and therefore uncorrelated). In report channel watching at and demonstrating, Gaussian commotion is utilized as delivered substance repetitive sound produce brought substance white Gaussian clamor. In media communications and computer networking, correspondence channels perhaps laid low with wideband Gaussian clamor originating from countless residence grown sources, which accommodates the nice and cozy vibrations of molecules in directors (alluded to as therma. Noise or Johnson-Nyquist commotion), shot commotion, darkish body radiation from the earth and other heat gadgets, and from divine sources along side the sun.

**Gaussian Noise in virtual photos:**

Principal sources of Gaussian noise in digital snap shots arise in the course of acquisition e.g. Sensor noise because of terrible illumination and/or immoderate temperature, and/or transmission e.g. Digital circuit noise. In digital snapshot processing Gaussian noise will also be decreased using a spatial filter out, although when smoothing an image, an undesirable ultimate results can also influence within the blurring of fine-scaled photograph edges and expertise since additionally they correspond to blocked excessive frequencies. Traditional spatial filtering tactics for noise elimination embody: indicate (convolution) filtering, median filtering and Gaussian smoothing.

**3. NOISE MODELS:**

The main deliver of noise in virtual pictures arises during photo acquisition (digitization) or for the duration of image transmission. The performance of picture sensor is stricken by variety of motives together with environmental circumstance at some point of picture acquisition or by way of the first-class of the sensing aspect themselves. For illustration, all through acquiring graphics with CCD digicam, sensor temperature and slight stages are most important elements that affecting the wide variety of noise in the picture after the following.

Pics are corrupted whilst for the duration of transmission of images. The main rationale of noise is given that of interfering in the channel that is used for the images transmission [3].We are able to model a loud image as follows:



The place A(x ,y) is the long-established image pixel price and B(x ,y) is the noise in the photo and C(x ,y) is the resulting noise picture.



Figure. 4.5 Typical Noise Model Type

**Uniform Noise:**

The uniform clamor motive by means of quantizing the pixels of picture to more than a few extraordinary levels is known as quantization commotion. It has about uniform circulation. Within the uniform clamor the extent of the dark estimations of the commotion are always distributed over an targeted assortment. Uniform clamor maybe utilized to produce any notable sort of commotion appropriation. This commotion is probably used to debase portraits for the analysis of snapshot recovering calculations. This clamor gives the most impartial or autonomous commotion

A math equations on a white background

Description automatically generated



**Figure.4.6 Example of Uniform Noise**

**Gaussian Noise or Amplifier Noise:**

This noise has a threat density function [pdf] of the ordinary distribution. It is likewise often called Gaussian distribution. It is a predominant part of the learn noise of an photo sensor that is of the steady stage of noise within the darkish regions of the photograph.





Figure. 4.7 Example of Gaussian Noise

**Salt and Pepper Noise**:

The salt-and-pepper clamour are likewise alluded to as shot commotion, motivation clamours or spike clamour that's usually due to the fact that of inaccurate memory areas ,breaking down pixel components inside the digital digicam sensors, or there might be timing botches within the arrangement of digitization .Within the salt and pepper clamor there are simply believable esteems exists that's an and b and the probability of every is underneath zero.2.If the numbers extra prominent than this numbers the commotion will weigh down out photo. For eight-piece photograph the ordinary price for 255 for salt-clamours and pepper commotion is zero reasons for Salt and Pepper Noise:

A. By means of memory mobile failure.

B. Through malfunctioning of digital digital camera’s sensor cells.

C. Via synchronization error in graphic digitizing or transmission.



Figure.4.8 Example of Impulse Noise

**Rayleigh Noise:**

Radar range and velocity images typically contain noise that can be modeled by the Rayleigh distribution.



Noise is a random variation of image Intensity and visible as a part of grains in the image. It may cause to arise in the image as effects of basic physics-like photon nature of light or thermal energy of heat inside the image sensors [16]. It may produce at the time of capturing or image transmission. Noise means, the pixels in the image show different intensity values instead of true pixel values that are obtained from image. Noise removal algorithm is the process of removing or reducing the noise from the image. The noise removal algorithms reduce or remove the visibility of noise by smoothing the entire image leaving areas near contrast boundaries. But these methods can obscure fine, low contrast details [1].

The common types of noise that arises in the image are:

a) Impulse noise,

b) Additive noise [9]

c) Multiplicative noise.

Different noises have their own characteristics which make them distinguishable from others. Image noise can also originated in film grain and in the unavoidable shot noise of an ideal photon detector. Image noise is an undesirable by-product of image captured.

**3.1 Various Sources of Noise in Images**

Noise is introduced in the image at the time of image acquisition or transmission. Different factors may be responsible for introduction of noise in the image. The number of pixels corrupted in the image will decide the quantification of the noise. The principal sources of noise in the digital image are: a) The imaging sensor may be affected by environmental conditions during image acquisition. b)Insufficient Light levels and sensor temperature may introduce the noise in the image. c) Interference in the transmission channel may also corrupt the image. d) If dust particles are present on the scanner screen, they can also introduce noise in the image.

**3.2 Types of Noise**

Noise to be any degradation in the image signal caused by external disturbance .If an image is being sent electronically from one place to another via satellite or wireless transmission or through networked cables, we may expect errors to occur in the image signal. These errors will appear on the image output in different ways depending on the type of disturbance in the signal. Usually we know what type of errors to expect and the type of noise on the image; hence we investigate some of the standard noise for eliminating or reducing noise in color image. Image Noise is classified as Amplifier noise (Gaussian noise), Salt-and-pepper noise (Impulse noise), Shot noise, Quantization noise (uniform noise), Film grain, on-isotropic noise, Speckle noise (Multiplicative noise) and Periodic noise.

**3.2.1 Amplifier Noise (Gaussian noise)**

The standard model of amplifier noise is additive, Gaussian, dependent at each pixel and dependent of the signal intensity, caused primarily by Johnson–Nyquist noise (thermal noise), including that which comes from the reset noise of capacitors ("kTC noise"). It is an idealized form of white noise, which is caused by random fluctuations in the signal [12]. In color cameras where more amplification is used in the blue color channel than in the green or red channel, there can be more noise in the blue channel.

Amplifier noise is a major part of the noise of an image sensor, that is, of the constant noise level in dark areas of the image. In Gaussian noise, each pixel in the image will be changed from its original value by a (usually) small amount [4]. A histogram, a plot of the amount of distortion of a pixel value against the frequency with which it occurs, shows a normal distribution of noise. While other distributions are possible, the Gaussian (normal) distribution is usually a good model, due to the central limit theorem that says that the sum of different noises tends to approach a Gaussian distribution.

Not only that but also Gaussian noise represents statistical noise having probability density function (PDF) equal to that of the normal distribution, which is also known as the Gaussian distribution. In other words, the values that the noise can take on are Gaussian distributed. The probability density function of a Gaussian random variable Z is given by: Where represents the grey level, µ the mean value and the standard deviation. A special case is white Gaussian noise, in which the values at any pair of times are identically distributed and statistically independently (and hence uncorrelated).

In communication channel testing and modelling, Gaussian noise is used as additive white noise to generate additive white Gaussian noise [3]. In signal processing, white noise is a random signal with a constant power spectral density. [4]The term is used, with this or similar meanings, in many scientific and technical disciplines, including physics, acoustic engineering, telecommunications, statistical forecasting, and many more .Example of Gaussian noise.

**3.2.2 Salt-and-Pepper Noise (Impulse Noise)**

Salt and pepper noise is sometimes called impulse noise or spike noise or random noise or independent noise. In salt and pepper noise (sparse light and dark disturbances), pixels in the image are very different in color or intensity unlike their surrounding pixels. Salt and pepper degradation can be caused by sharp and sudden disturbance in the image signal. Generally this type of noise will only affect a small number of image pixels. When viewed, the image contains dark and white dots, hence the term salt and pepper noise [13].

Typical sources include flecks of dust inside the camera and overheated or faulty (Charge-coupled device) CCD elements. An image containing salt-and-pepper noise will have dark pixels in bright regions and vice versa. This type of noise can be caused by dead pixels,It known as impulsive noise. It appearances is randomly scattered white or black pixel over the image. It sometimes happen for memory cell failure,for synchronization errors in image digitizing or transmission. This type of noise can be caused by analog to digital converter errors,bit error in transmission. Example of saltand-pepper noise: Original image before and after noise.

**3.2.3 Shot Noise**

The dominant noise in the lighter parts of an image from an image sensor is typically that caused by statistical quantum fluctuations, that is, variation in the number of photons sensed at a given exposure level; this noise is known as photon shot noise. Shot noise has a root mean-square value proportional to the square root of the image intensity, and the noises at different pixels are independent of one another. Shot noise follows a Poisson distribution, which is usually not very different from Gaussian. In addition to photon shot noise, there can be additional shot noise from the dark leakage current in the image sensor; this noise is otherwise known as "dark shot noise" or "dark-current shot noise".

**3.2.4 Quantization Noise (Uniform Noise)**

The noise caused by quantizing the pixels of a sensed image to a number of discrete levels is known as quantization noise; it has an approximately uniform distribution, and can be signal may dependent, though it will be signal independent if other noise sources are plenty that cause dithering, or if dithering is explicitly applied.

**3.2.5 Film Grain**

The grain of photographic film is a signal-dependent noise, related to shot noise. That is, if film grains are uniformly distributed (equal number per area), and if each grain has an equal and independent probability of developing to a dark silver grain after absorbing photons, then the number of such dark grains in an area will be random with a binomial distribution; in areas where the probability is low, this distribution will be close to the classic Poisson distribution of shot noise; nevertheless a simple Gaussian distribution is often used as an accurate model.

**3.2.6 Speckle Noise (Multiplicative Noise)**

Speckle is a granular 'noise' that inherently exists in and degrades the quality of the active radar and synthetic aperture radar (SAR) images.[6] 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.[10]It is caused by coherent processing of backscattered signals from multiple distributed targets.

In SAR oceanography, for example, speckle noise is caused by signals from elementary scatters, the gravity-capillary ripples, and manifests as a pedestal image, beneath the image of the sea waves. Synthetic Apertures Radar (SAR) technique is popular because of its usability under various weather conditions, its ability to penetrate through clouds and soil. A SAR image is a mean intensity estimate of the radar reflectivity of the region which is being imaged. Speckle noise in such system is to be referred as the difference between a measurement and the true mean value. Degraded image with speckle noise in ultrasound imaging is given by the equation. G(n,m)= f(n,m)\*u(n,m)+ξ(n,m) Where g(n,m) is the observed image. u(n,m) is the multiplicative component and ξ(n,m) is the ξ(n,m) is the additive component of the speckle noise. Here and denotes the axial and lateral indices of the image samples. While Gaussian noise can be modeled by random values added to an image, speckle noise can be modeled by random values multiplied by pixel values hence it is also called multiplicative noise. Speckle noise is a major problem in some radar applications.

**4. Removing Noise from Images by Filtering**

Image noise is an unavoidable side-effect occurring as a result of image capture, more simply understood as inaudible, yet inevitable fluctuations. In a digital camera, if the light which enters the lens misaligns with the sensors, it will create image noise. Even if noise is not so obviously visible in a picture, some kind of image noise is bound to exist. Every type of electronic device receives and transmits some noise and sends it on to what it is creating. When the images are transmitted over channels, they are corrupted with impulse noise due to noisy channels.

This impulse noise consists of large positive and negative spikes [4]. The positive spikes have values much larger than the background and thus they appear as bright spots, while the negative spikes have values smaller than the background and they appear as darker spots. Both the spots for the positive and negative spikes are visible to the human eye. Also, Gaussian type of noise affects the image.

Thus, filters are required for removing noises before processing. There are lots of filters in the paper to remove noise. They are of many kinds as linear smoothing filter, median filter, wiener filter and Fuzzy filter. In this filtering technique, the three primaries(R, G and B) are done separately. It is followed by some gain to compensate for attenuation resulting from the filter. The filtered primaries are then combined to form the colored image [3]. This process is very simple. This approach shown in figure below as.

**5. SCOPE FOR FUTURE** **WORK**

There are a couple of areas which we would like to improve on. One area is in improving the de-noising along the edges as the method we used did not perform so well along the edges. Another area of improvement would be to develop a better optimality criterion as the MSE is not always the best optimality criterion. The future work of research would be to implement Wiener Filter in Wavelet Domain, applying the methods in which the noise variance is known & in which the noise variance is unknown i.e. the MAD method.

The need to find a way to remove the noise while preserving the edges of the image as much as possible, because the methods used in this research have removed noise, but by observing the resulting images we found that the edges have been affected and in some types of noises and after the application of the three filters affected by the quality of the image and distort the Image features.