A Hybrid Intelligent Approach of Image Restoration by using Median and Decision Filtering Techniques

Mohd. Junedul Haque

Research Scholar OPJS University
Churu, Rajasthan, India
Email: qmjhaq@yahoo.co.in

Abstract—**Image process could be a methodology to convert a picture into digital type and perform some operations on that, so as to induce an enhanced image or to extract some helpful data from it.Noise in image- Noise in image is introduced due to many reasons like atmospheric disturbances, focus of the image etc. Image Restoration includes processes that decide to take away degradations/noise and restore the initial image. Restoration is distinguished from improvement in this degradation is thought as an external influence that's become distinguished image signal. There are different filtering techniques that are to be applied on image to make an image noise free. But such filtering techniques are not enough to remove the noise from the image because one filter is not sufficient, thus we propose combination of hybrid filters in this paper that are required to make an image noise free. Performance evaluation of proposed filter is measured on the basis of MSE and PSNR.**

Keywords- Image Restoration, Noise, Image Noise Model, Denoising, Filters

1. INTRODUCTION

Image processing means that deals with varied actions to alter a picture. DIP could be a part of signal process wherever process of digital pictures exploitation varied sorts of computer algorithm. This algorithm is often changed in order that to conjointly modification the looks (color, size) of the digital image simply and quickly. Digital Image process has varied applications in varied studies and researches of science and technology [1]. Pictures square measure made to record or show helpful info or details .Due to flaws within the imaging and capturing method, however, the recorded image forever represents a degraded version of the initial scene [2].Mainly Image process system contains pictures as two dimensional signals whereas applying already set signal process strategies to them. Image process essentially includes the subsequent three steps: import the image with optical scanner or by photography, analysing and manipulating the image which has knowledge compression and image improvement and restoration and output is that the last stage within which result may be altered image or report that's supported image analysis [3].

1.1 What is Image Restoration?

Image Restoration is referred as method to revive a degraded/distorted image to its original content and quality. The main motive of restoration is to boost the standard of a digital image that has been degraded as a result of varied kinds of noise or blur superimposed into it.. Once all repairs are created to the copy by using computer software, a brand new print will be created. The ultimate digital photograph file of the repaired photograph will be saved as a repository copy and replaces requirement for a negative [4].

1.2 Image Restoration Process

It deals with raising the looks of a picture. The Image is corrected mistreatment totally different with raising the looks of a picture. The Image is corrected mistreatment totally different correction ways like Median filtering, linear filtering, adjective Filtering etc so as to revive a picture to its original forms. Fig 1.1 shows a model of the image restoration [5].

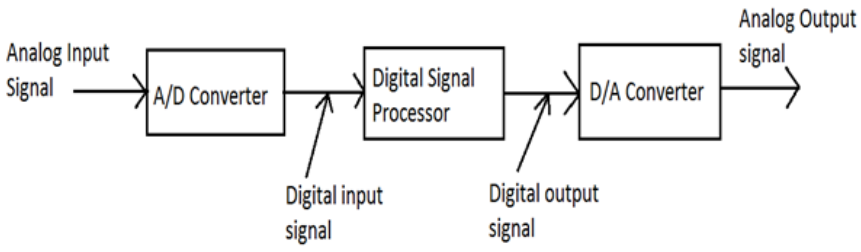

Fig 1.1 showing process of Digital Image Processing

1.3 Noise

Image noise is random disparity of brightness or colour information in image. An aspect of electronic noise may be made by the sensing element and circuitry of a scanner. Film grain conjointly up by image noise. Image noise is an undesired by-product of captured image that adds spurious and extraneous information. Image noise is random changes contrast pictures."Noise" implies that "discarded signal"; unwanted electrical fluctuations in signal received by AM radios caused sounding acoustic noise ("static"). By analogy redundant electrical fluctuations themselves came to be referred to as "noise". Image noise is, of course, inaudible. Photographs corrupted by impulse noise usually occurred in practice. This kind of noise might seem in digital pictures due to channel decoder damages, colouring down of signal in communication links, communication subscriber's moving, video sensor's noises and alternative. The impulse noise known as salt and-pepper causes white and black points appears in digital grey scale pictures, which chaotically scattered along image space. Applying of classic median filter for removal of such kind of noise offers comparatively sensible results, that square measure revealed in restoring of brightness drops, objects edges and native peaks in noise corrupted pictures [6].

1.4 Image Noise Model

Whenever noise is discusses, everybody knows that noises are often introduced within the image, either at the time of image generation (e.g. whenever we use camera and photographic films to capture an image) or at the time of image transmission. Keeping these totally different classes of noise having certain characteristics. Another type of noise that is present throughout the image transmission is Salt-Pepper noise. It seems as black and/or white impulse of the image. Such noises occur usually man-made or environmental noise that seems as impulsive noise. It has following form: where (k, j) denotes the impulse and i(k, j) denotes the initial image intensity at the pixel (k, j). As in case of the-CCD cameras, the most type of noise is that the transfer loss noise [7]

1.5 Denoising

In day today times, visual data is usually transmitted within in the form of digital pictures, however the pictures thus obtained are usually corrupted with noise which is undesirable and unwanted component that is intruded within the image at the time of acquisition or transmission from sender to receiver, thereby decreasing the standard of image. The noise might seriously have an effect on the performance of image process techniques. Hence, an economical de-noising technique becomes a really vital issue in image processing[8].De-noising a picture is an elementary task for correcting defects created throughout the acquisition method of a real world scene and its reproduction on display, owing to physical and technological limitations. It can even be helpful as a pre-processing stage so as to boost the results of higher level applications. The process of removing the noise of a picture whereas conserving its main features (edges, textures, colours, contrast, etc.) has been extensively examining the facts over the last two decades and a number of other sorts of approaches are developed [7].

1.7 Filters

Elimination of noise is one amongst the key works to be done in computer vision and image process, as noise results in the error within the image. As any noise within the image are often lead to serious errors. Noise is an undesired signal that is manifested by undesirable data. So the image that gets contaminated by the noise is that the degraded image and using different filters will filter this noise. So filter is a very important system of any signal process system. Thus filters are used for enhancing the image, because it removes undesirable signal elements from the signal of interest. Filters are of various types' i.e. linear filters or nonlinear filters [4].

2. RELATED WORK

The research work performed in this field by diverse researchers is presented as follows:

Er. Jyoti Rani [1] Author provides introduction of digital image process is delineated. Primarily this paper is expounded to image restoration, differing types of noises are introduced and totally different ways that are accustomed take away noise are delineate. Totally different parameters are delineating to match the results of various ways that are used. All the work is completed on medical pictures. At the tip of paper reference and conclusion is additionally delineate.

Anamika Mauryaet. al. [2] Author offer an elliptical summary of most helpful restoration models .Different types of image restoration techniques such wiener filter, inverse filter, regularised filter, Richardson –Lucy algorithmic rule, neural network approach, wavelet primarily based approach, blind DE convolution are delineated and strength and weakness of every approach are known.

Pooja Kaushik [3] the author compared the various image sweetening techniques by victimisation their quality parameters (MSE & PSNR) & planned a replacement erosion sweetening technique. This system provides higher result than alternative techniques and their PSNR price is high & MSE is low. The experimental results show that the planned sweetening technique provides higher results.

Geoffrine Judith. M. C [4] Author introduces a brand new call based mostly median filtering rule is conferred for the removal of impulse noise from digital pictures. Here, this paper the impulse noise corrupted pel by the median of the pel scanned in four directions. The signal restoration theme of this filter adapts to the various impulse noise ratios whereas deciding Associate in nursing applicable signal trained worker from a reliable neighbourhood. The experimental results of this filter applied on numerous pictures corrupted with the majority ratios of impulse noise favour the filter in terms of judgment and sound judgement than several of the opposite distinguished impulse noise filters.

Chaahatet.al. [5] the basic plan is match the missing block with the data propagating from the encircling pixels. During this paper, "Probabilistic Recovery Filling-In Technique for Image restitution" which is able to notice the corrupted and missing constituents and also the likelihood of recovery on explicit pixel is projected. For corrupted pixels, if likelihood of recovery of constituent is <hr then matching of the constituent from close are going to be done. If recovery likelihood of corrupted constituent is >60%, then matching of the constituent are going to be through with the remaining a part of that specific constituent. For fully missing pixels, finding the missing block method are going to be carried and matching with close is nice possibility during this case. The analysis can offer higher quality of image once recovery.

Gabriela Ghimpeteanu [6] Author contemplates a picture decomposition model that has a completely unique framework for image denoising. The model computes the parts of the image to be processed in an exceedingly moving frame that encodes its native pure mathematics (directions of gradients and level lines). Then, the strategy authors have a tendency to develop is to denoise the parts of the image within the moving enclose order to preserve its native pure mathematics, which might are a lot of affected if process the image directly. Experiments on full image information tested with many denoising ways show that this framework will offer higher results than denoising the image directly, each in terms of Peak S/N and Structural similarity index metrics.

Charu Khare et.al. [7] Author presents a completely unique approach to method the image mistreatment completely different filtering strategies by Image Restoration. The aim is to reinforce the digital image, reconstruct it into the first kind from the clattering image. This paper is an outline of effective algorithms which will be used for image restoration. For which, techniques square measure used on the premise of non linear filters to revive the image. The performance of bar graph accommodative Fuzzy (HAF) filter is fastidiously examined and compared with alternative filters like, Weighted Fuzzy Mean (WFM) filter, Minimum-maximum Detector based mostly (MDB) filter, accommodative Fuzzy Mean (AFMF) filter, Centre Weighted Mean (CWM) filter, and Min-max Exclusive Mean(MMEM) filter on the premise of (Peak Signal to Noise Ration) PSNR. Experimental results on pictures can illustrate the capabilities of all the studied approaches.

Easwara M. [8] Author uses a detail-preserving filter supported the Cloud Model (CM) to get rid of severe impulse noise. CM is associate degree unsure conversion model, between qualitative and quantitative description that integrates the construct of randomness and opaqueness conventional random range generation technique in traditional cloud generator algorithmic rule overcomes the insufficiency of common technique to get random numbers. It will manufacture random numbers which may be certain and replicated, and this random numbers gift to be a random sequence as a full. The digital options of the conventional cloud characterised by 3values with the expectation Ex, entropy nut and Hyper entropy He and area unit ok to represent a standard cloud. First, associate degree uncertainty-based detector, normal cloud generator, recognize the pixels corrupted by impulse noise. Then, the known noise pixels area unit replaced by a fuzzy mean estimation of the processed noise free pixels among the detection window. Compared with the normal change filters, the CM filter makes a good improvement in image denoising. Especially, at high density background level. Thus, the cloud model filter will take away severe impulse noise whereas conserving the image details.

3. PROPOSED WORK

A. Problem Formulation

Image quality is a characteristic of an image that measures the supposed image degradation (typically, compared to an ideal or perfect image). Imaging systems may introduce some amounts of distortion or artifacts' in the signal, so the quality assessment is an important problem.Image noise is taken into account as undesirable

by-product of capturing image. The categories of noises are Gaussian noise, salt and pepper noise, tarnish noise, Brownian noise etc. There are different filtering techniques that are to be applied on image to make an image noise free. But such filtering techniques are not enough to remove the noise from the image because one filter is not sufficient, thus a combination of hybrid filters are required to make an image noise free.

B. Proposed Work

Proposed a hybrid noise filter which is the combination of two or more filters used for removing the noise from the images. Performance evaluation of proposed filter on the basis of MSE and PSNR. An image is said to be noise free if it has high value of PSNR and low value of MSE.

4. RESULTS AND ANALYSIS

PSNR (Peak Signal To Noise Ratio) is defined as an expression for the ratio between the maximum possible value (power) of a signal and the power of distorting noise that influence the quality of its representation.To calculate the value of PSNR of the images, firstly we open the matlab and open in it the main program in the matlab stored with a name main.m. Look for the images in TestImages folder.

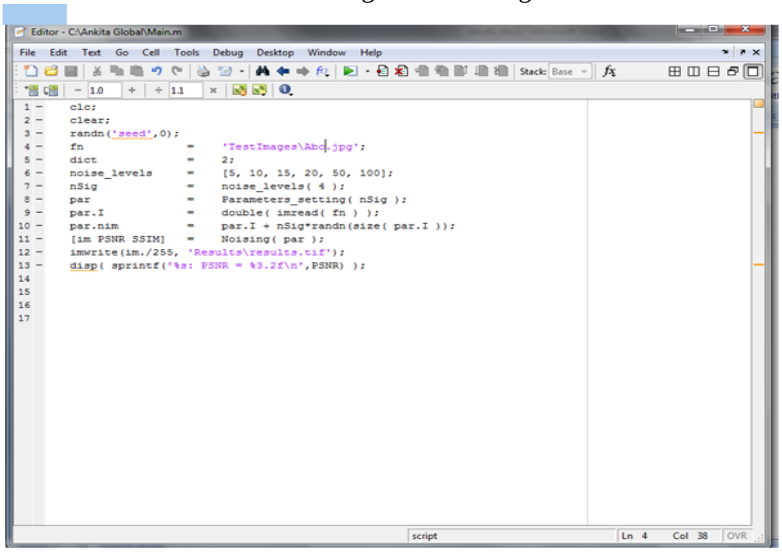

Figure 4.1 Main program

Following is the folder stored in system with a name TestImages. This folder contains the images on which the filters are applied to calculate the peak signal to noise ratio value.

Figure 4.2 Folder containing test images

Figure 4.2 Folder containing test images

Open the main program in the window, gives the pathname of the image location. Save the program and run the program.

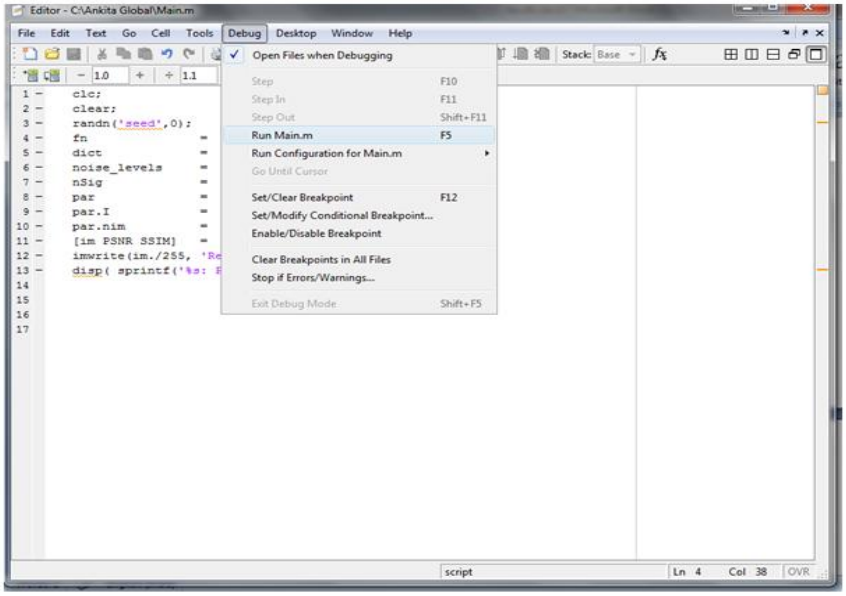

Figure 4.3 Executing Main program

Firstly it shows the PSNR value of the Noisy Image as shown in the figure 4.4 The PSNR of the noisy image =27.47

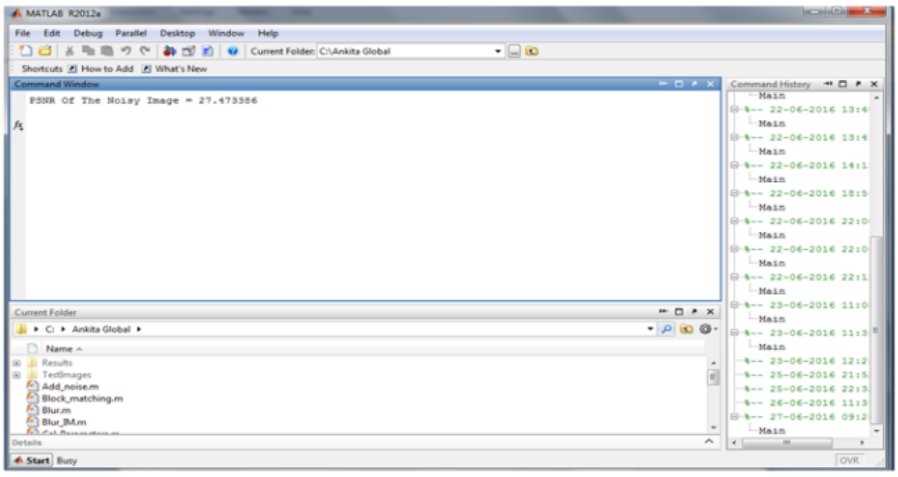

Figure 4.4 PSNR of noisy image

After calculating the PSNR of the noisy Image, Iterations starts which calculates the PSNR value of the image.

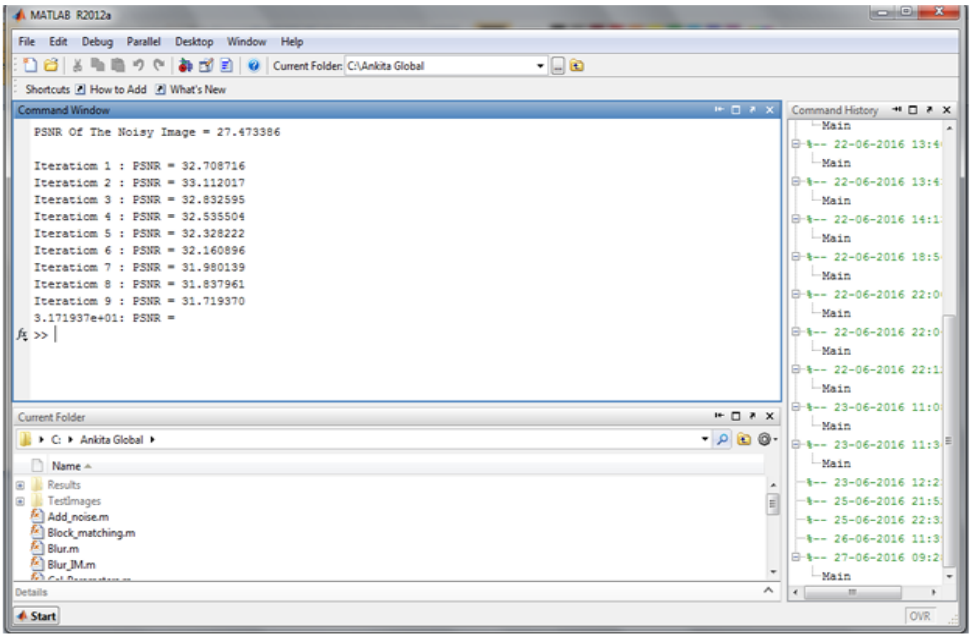

Figure 4.5 Execution of Hybrid filter

There are total 9 iterations takes place which gives different values of PSNR. Average value of PSNR of the image can be calculated by adding all the values of the iterations and divide these values by the total number of iterations.

Here we calculate the average value of the iterations of the image Abc.jpg

32.70 + 33.11 + 32.83 + 32.53 + 32.32 + 32.16 + 31.98 + 31.83 + 31.71 / 9 = 291.17 / 9 = 32.25

So, the average value of PSNR from the iterations is calculated.

Similarly, we calculate the average value of the PSNR for other image too.

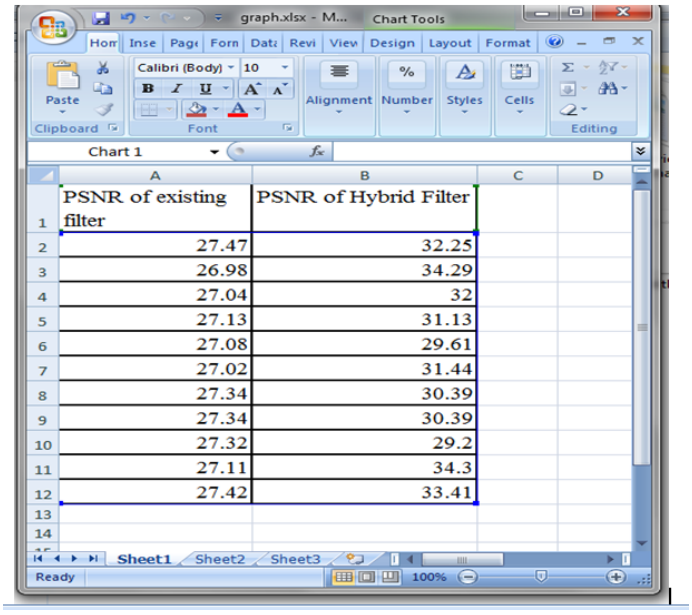

Figure 4.6 PSNR of all test images

Figure 4.6 shows the calculated PSNR value of the image from existing filter and using hybrid filter. From the figure we can draw a graph that shows the value of the PSNR derived from the existing filter as well as from the Hybrid filter.

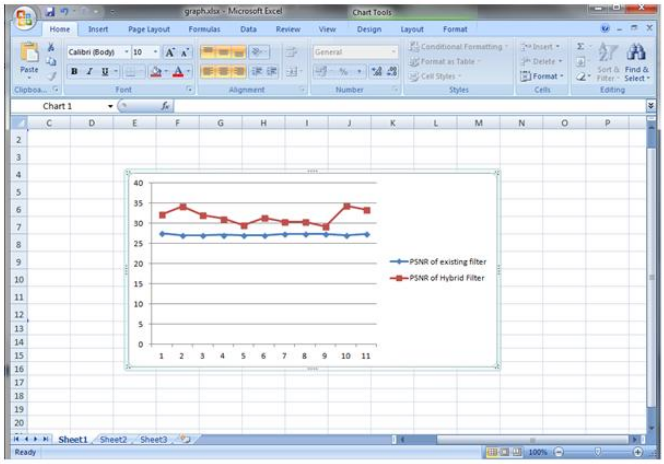

Figure 4.7 Graphical comparison of PSNR of existing and proposed filter

Following is the graph derived from the table, blue colour graph which shows the PSNR value of the existing filter and red graph shows the values derived from the existing filter.The graph it is clearly shows that value of PSNR is more when used a hybrid filter as compared to the existing filter.

Table 4.1 Comparison between PSNR of noisy image and PSNR of denoisy image

S.No	Noisy Image	PSNR of Noisy Image	Denoisy Image	PSNR of Denoisy Image
1.		29.505567		32.393077
		8		4
7.		29.738786		34.200969
8.		29.780387		32.011311
9.		29.498406		31.212584
10.		29.921536		33.629300

5. CONCLUSION

Noise reduction or removal is the actually meaning of filtering, or to increase or fetch a particular set of attributes like edges. Good result on the basis of PSNR value provided by median filter, Hybrid filter removed all the limitation of median filter and it showed better result as compared to median filter. But a proposed filter Hybrid decision filter overcome limitations of both filters and showed best result.

The performance of the Decision Based algorithm was tested over a wide variety of 16-bit colored images of 512×512 size against Median Filter and is found to perform quite well on images corrupted with impulse noise. The PSNR values obtained using different filtering techniques at different levels of impulse noise are calculated. It can be noted that the new hybrid filter produces low MSE and high PSNR when compared to median Filter.

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