Noise Reduction of an Image by using Function Approximation Techniques.

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***Abstract*— In this proposed work, an efficient simple, fast technique is given to remove noise of an image which is mostly introduced due to environmental changes. We focus on the noise issues that changes image pixels value either on or off. The pixels are easily identified as noisy pixels in grayscale image but it is difficult to recognize in RGB color image. Reason behind it is that, any color combination with white (pixel on) or black (pixel off) generate other color. This paper focus on such technique that reduces the noise in both grayscale and RGB image with recovery of originality of source image.**

Keywords: Random Function Approximation, Salt Peeper Noise, Luminance, Noise Blur.

I. INTRODUCTION

Image quality improvement has been a concern throughout the field of image processing. Images are affected by various types of noise. Noise in an image is undesirable because it degrades image quality [2]. An application of noise reduction in an image processing is a promising research fields. Fuzzy techniques have already been applied in several domains of image processing and have numerous practical applications [5]. Image noise is usually unwanted, variation in brightness or color information is considered as a noise .Image noise can originate in film grain or in electronic noise in input device sensor and circuitry, or in the unavoidable short noise of an ideal photon detector .Image noise is most apparent in image region with low signal level, such as shadow region or under expose images.

II. LITERATURE REVIEW

Many techniques for noise reduction replace each pixel with some function of pixel's neighborhood [9]. 1-D features and 2-D noise usually have common frequency components; they are not separable in the frequency domain. Linear filters tend either to amplify the noise along with the 1-D features or smooth out the noise and blur the 1-D features. Researchers have introduced a number of adaptive noise reduction algorithms. Essentially, these attempt to detect non noise edges in the image. The algorithms modify their behavior near the edges in order to preserve them. Edge detection is, however, a difficult problem in its own right. Enhancement algorithms that depend on edge detection incorporate all the problems associated with edge detection undetected edges, spurious edges, etc [3]. Nevertheless, the idea of adapting the smoothing procedure near 1-D features so that the procedure does not blur them could, in theory, lead to an algorithm that meets goals. Median filter is normally used to reduce noise in an image somewhat like the mean filter [5]. Median filter consider each pixel in the image in turn and look at its nearby neighbor to decide whether or not it is represent is surrounding. Gaussian filter is windowed filter of linear class; by its nature is weighted mean. Named after famous scientist Carl Gauss because weight in the filter calculated according to Gaussian distribution. Another name for this filter is Gaussian Blur [7].

III. PROPOSED SYSTEM

This project has following phases

A. Input an image.
B. Recognize an input image either as noisy or noiseless (user choice).
C. For noisy color image, convert it into grayscale and remove noise using noise removal **Random Function Selection Approximation Technique (RFSAT)**.
D. Recover color using one of the reference image (most probably reference image is input color RGB image).
E. For noisy grayscale image, remove noise using noise removal **Random Function Selection Approximation Technique (RFSAT)**.
F. Display result.

Consider following data flow diagram that explain overall flow

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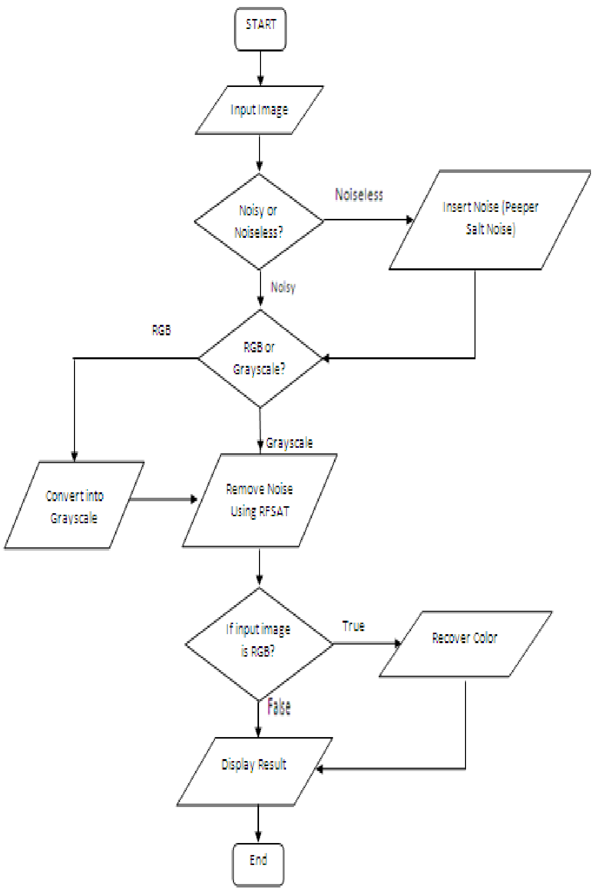

Figure 3.1 Data Flow Diagram

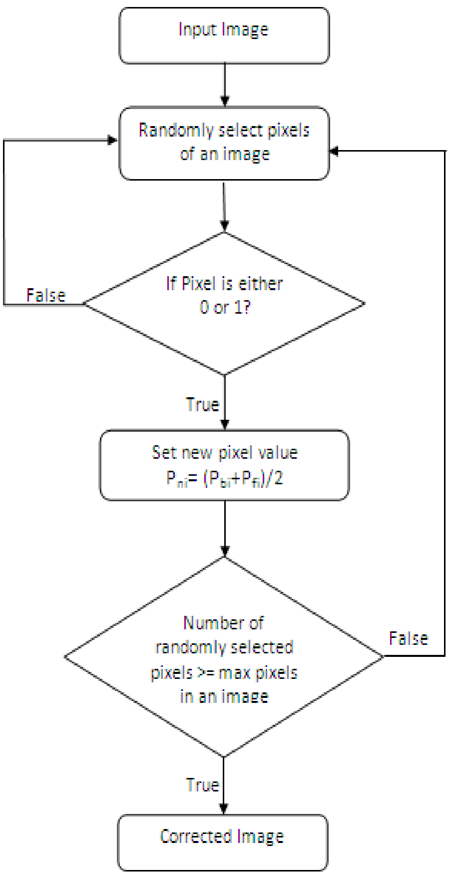

Figure 3.2 RFSAT Flow Chart

Fat-Tail distributed or impulse noise is sometimes called a salt and pepper noise or spike noise. An image containing salt and pepper noise will have a dark pixels in bright region and bright pixels in dark region. This type of noise can be caused by dead pixels, analog to digital converter error, bit errors in transmission etc. Let's see following images

Figure 3.3(a)

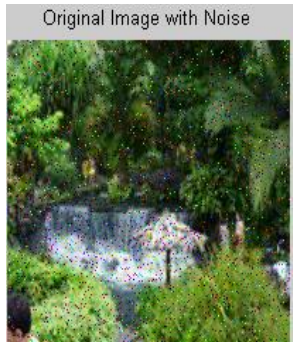

Figure 3.3(b)

In this project we mostly focused on salt and pepper noise which is mostly introduced because of change in environment.

Random pixel selection

We are considering a noisy input image and we select pixels randomly with equation

$$Pxy = \lim_{i=1} n\left(rand(xi, yi)\right) \text{ ---------------- e.q 3.1}$$

P_{xy} = randomly chosen pixel

x_i= X co ordinates of chosen pixel

y_i= Y co ordinates of chosen pixel

If

$P_{xy} = 0 || P_{xy} = 1$ it means pixel is noisy, which set to its new value

$$Pni = \frac{Pbi + Pfi}{2} \text{ ----------------------------e.q 3.2}$$

It is observed that random pixel selection method consumes time but it covers approximately all the noise pixels of an image. From the literature review it is observed that, while removing the noise from color image, color information gets lost, that's why we convert a noisy color image into grayscale image (See Figure 3.3(a)). Color recovery of noisy image is a vital task and can be achieved by comparing Luminance factors of original RGB image and noisy Grayscale image. Consider equations

$L_{fr}=| L_i - L_f|$-------- e.q 3.3

Where

$$L_i= \sum_{i=0}^{n} Pi \left[\left(\frac{Pr+Pg+Pb}{r}\right) + \left(\frac{Pr+Pg+Pb}{g}\right) + \left(\frac{Pr+Pg+Pb}{b}\right)\right] \text{ eq3.4}$$

$$L_f= \sum_{i=0}^{n} Pf \left[\left(\frac{Pfr+Pfg+Pfb}{fr}\right) + \left(\frac{Pfr+Pfg+Pfb}{fg}\right) + \left(\frac{Pfr+Pfg+Pfb}{fb}\right)\right] \text{ eq3.5}$$

L_i=Gray scale factor of original Gray scale image.
L_f= RGB factor of original reference image.
P_r=Red component decimal value of input Gray scale.
P_g=Green component decimal value of input Gray scale.
P_b=Blue component decimal value of input Gray scale.
P_{fr}=Red component decimal value of reference image.
P_{fg}=Green component decimal value of reference image.
P_{fb}=Blue component decimal value of reference image.
If
$L_{fr} \leq 0 \leq 10$--- e.q 3.6
It means both the pixels have a matching color parameters else not.

IV. EXPERIMENT RESULT

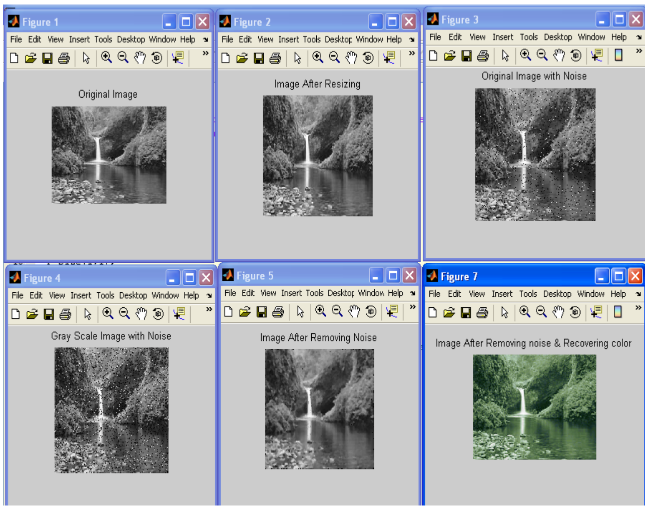

Figure 4.1 Experiment result.

Sr No.	Image Type	No of greyscale images tested	% of noise	% of noise removal	Accuracy	Identity Factor
1	JPEG	50	80 - 90%	75 - 85%	93.75%	0.812
2	PNG	50	80-90%	70 - 75%	87.36%	0.801
3	BMP	50	80-90%	75 - 85%	93.75%	0.875
4	GIF	50	80-90%	75 - 80%	93.75%	0.902
5	TIFF	50	80-90%	70 - 80%	87.36%	0.850

Figure 4.2 Result Analysis

V. CONCLUSION

We present a novel approach to reduce noise from an image by using RFSAT. The efficient filtering of image data corrupted by noise and calculates restored pixels values fastest than all of the previous work. The corrected image appears to be peppered with low noise, although the images produced preserved the sharpness of the edges better than the previous work.

FUTURE WORK

In future we try to implement and/or modify the proposed work so that it can smooth the distinct region of the image without losing the color information and improve their space and time complexities by implementing them more efficiently.

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