

# A Real Time Approach to Compare PSNR and MSE Value of Different Original Images and Noise ( Salt and Pepper, Speckle, Gaussian) Added Images

<sup>1</sup>Raushan Kumar, <sup>2</sup>Gunjan Sharma, <sup>3</sup>Varun Sanduja

<sup>1,2</sup> *Electrical engineering, Sant Longowal Institute of Engineering and Technology, Sangrur, Punjab (India)*

<sup>3</sup> *Assistant Professor, Electronics and Communication Engineering Department, Chandigarh Group of Colleges, Jhanjeri, Punjab (India)*

**Abstract-** Determination of image quality is an important part of digital image processing as many different types of noise degrades the quality of image. There are many different techniques to evaluate the quality of image. The most commonly used technique is pixel based difference measures which include PSNR(peak signal to noise ratio),SNR(signal to noise ratio),MSE(mean square error). Here , by working on real time images and later adding noise(speckle, salt & pepper, Gaussian) to images and then calculate and compare the PSNR and MSE value for different images.

**Keywords—** PSNR, MSE, Real Time, Digital Image Processing, Image Quality, Noise.

## I. INTRODUCTION

In this era of advanced technology where innovations and researches are progressing day by day, measurement of image quality is essential for digital image processing but due to faults in communication system noise addition makes it laborious to study image for any purpose [1]. In addition due to advancement of multimedia technologies the utility of digital images is growing exponentially and hence the need of image quality assessment and its improvement is also increasing [2].

Digital image is formed from the combination of pixels. During image acquisition process (storing, processing, compressing) the image quality diminishes from the point they are captured till shown before human eye [3]. Main reasons are the defective of pixels in sensors, faulty memory location in hardware. Normally image quality is mainly degrades by impulse noise, speckle, gaussian etc.. Improvement of image quality and suppression of noise is the two essential feature of digital image processing[4]. Real time image processing has wide range of applications from biometrics to agriculture[5]. There are primarily two technique for image quality assessment .(i) subjective method (ii) objective method. The subjective method for image quality assessment is old, expensive and time consuming because here in this method a number of human beings are

asked to evaluate and score the quality of image based on their visual capabilities and hence inconvenient. On the other hand, objective method uses automatic algorithm for image quality assessment without the help of human judgment . The objective image quality assessment is divided into three categories according to original image.

(A) Full Reference: where reference image is known.

(B) Reduced Reference: where the reference image is partially exist in the form of some extracted features as information and then they are further used for evaluation.

(C) No Reference: when there is no reference image provided. Here in this work we only focused on full reference image quality assessment[6] and speckle, salt & pepper, Gaussian noise added digital images.

**Speckle Noise:** This is a multiplicative noise. They are basically present in coherent imaging system such as laser, radar , acoustics etc. They are present identical to Gaussian noise.

**Salt & Pepper Noise:** This noise not fully degrades the original image rather only some pixel values are changed . Mainly this noise is present in data transmission.

**Gaussian Noise:** Another name for Gaussian noise is electronic noise because it arises in amplifiers or detectors. It is mainly caused by natural sources such as thermal vibration of atoms etc[7].

**Error analysis**

The image quality assessment based on pixel difference method has been done by calculating PSNR, SNR and MSE value. They are the error metrics used to compare images.

**Mean Square Error(MSE):** It is the cumulative squared error between the original image and the noise added image.

The lower the level of MSE , lower the error.

$$MSE = \frac{\sum_{M,N} [I_1(M,N) - I_2(M,N)]^2}{M*N} \quad (1)$$

Here M and N are the no of rows and columns in the input image respectively. Hence , to evaluate PSNR firstly MSE value should be calculated.

Peak Signal to Noise Ratio(PSNR) and signal to noise ratio(SNR) are mathematical measure for image quality assessment between original image and noise added image. It shows the measure of peak error.

$$PSNR = 10 \log_{10} \frac{R^2}{MSE} \quad (2)$$

Here R is maximum fluctuation in input image data type. PSNR measures the peak error[8].

## II. RELATED WORK

A. According to Yusra A. Y. Al-Najjar and Dr. Der Chen Soong image quality measurement is complicated and difficult process. There are many different techniques for image quality measurement but no one is treated as the ideal method .They have done appreciable work on image quality assessment techniques such as pixel difference based measurement and human visual based measurement and later came to the conclusion that even if subjective IQM are more time consuming , expensive but still give better results than objective IQM also objective IQM field needs a lot of work[3].

B. In paper ‘An investigation on quality of denoised images’ Peter Ndajah, Hisakazu Kikuch, Masahiro Yukawa, Hidenori Watanabe, Shogo Muramatsu concluded that the error sensitivity metrics such as PSNR, MSE, RMSE, SNR alone are not sufficient to determine the quality of de-noised images and a better metric SSIM ( structural similarity metric ) should be used for its determination as its value is not affected by the dynamic range of image[9] .

C. Kaiwen Zhang, Shuozhong Wang, and Xinpen Zhang has proposed a paper on pixel based correlation weighted mean square error (WMSE) quality metric for image quality assessment. According to them with MSE only gray level difference between individual pixels of original and distorted images are evaluated but with WMSE correlation between neighboring pixels is also taken into consideration. Thus, WMSE is better image quality metric than MSE[10].

D. C.Sasi varnan, A.Jagan, Jaspreet Kaur, Divya Jyoti, Dr.D.S.Rao in their research paper presented that the MSE,PSNR metrics does not give satisfactory result when they are used to measure image quality across different distortions but SSIM give better result for the same except in case of highly blurred images. The SSIM formula has major drawback that it is only applicable to measurement of still

black and white images but needs to be modified for color images[6].

E. Parminder Kaur and Jagroop Singh presented a research paper on the effect of Gaussian noise on PSNR value for digital images and came to the conclusion that as the level of

Gaussian noise is increasing in test image, the PSNR value goes on decreasing for the same[11].

F. Pinki and Rajesh Mehra with respect to image quality assessment concluded that as the image quality is improved it result in increasing structural similarity and peak to noise ratio but mean square error value get reduced. With the variation of complexity of image the structural similarity and peak signal to noise ratio changes which suggested that structural similarity measurement give better result[12].

## III. METHODOLOGY

In this work, Firstly real time images are captured and they are referred to as original images and then different types of noise are added to these original images such as speckle, salt & pepper and gaussian noise. Later, by calculating PSNR and MSE value for these real time images we estimate that which method is more appropriate for image quality assessment in real time.

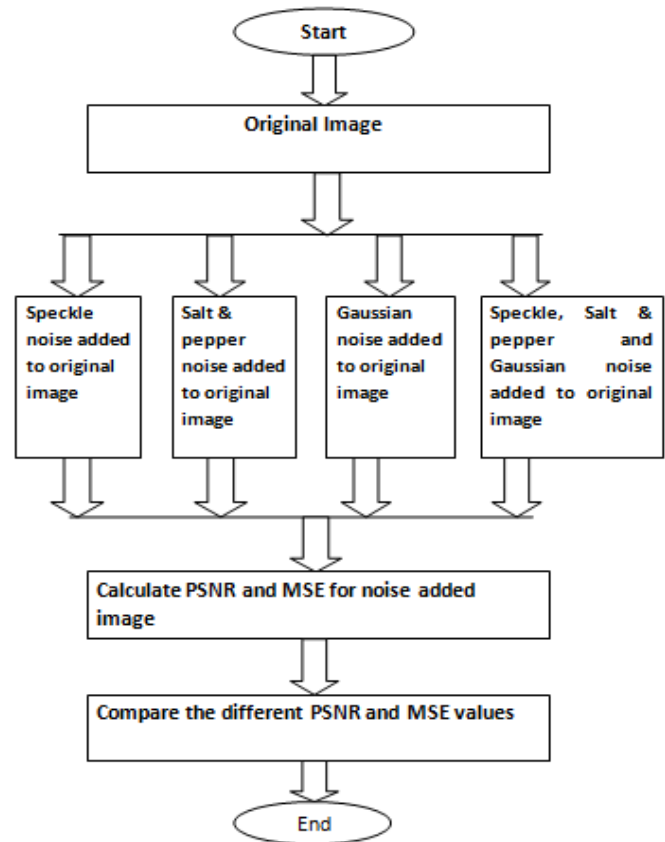


Fig.1. Algorithm for estimation of image quality

#### IV. RESULT AND DISCUSSION

The observations are made by applying above proposed algorithm on different real time images. Results are displayed for a particular real time image but the value of PSNR and MSE is calculated for different images using MATLAB, it provides with different toolbox including image acquisition toolbox which helps in determining different image quality metrics and by estimating these values and performing different techniques for image quality improvement.

Here, test image is GRV and the following observations are shown in different images.

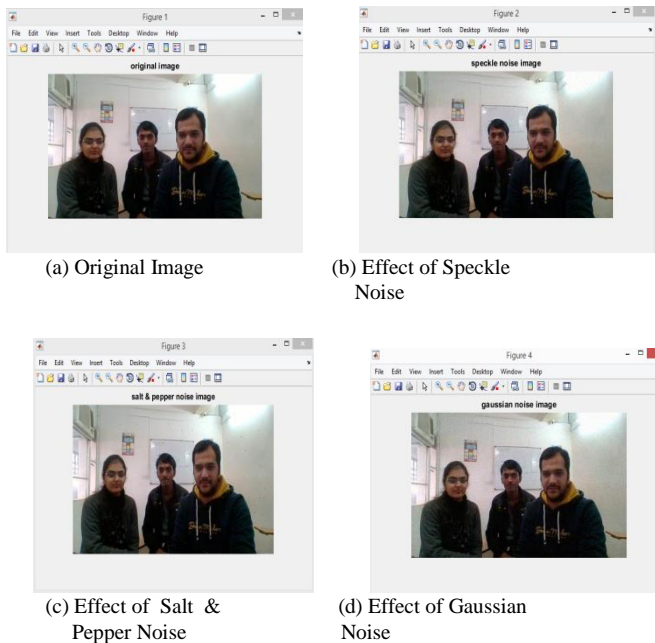
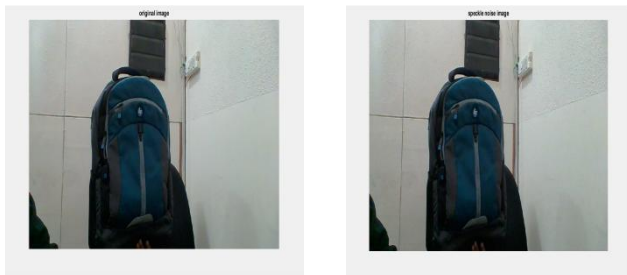


Fig. 2 . First Case (GRV Image)

The PSNR and MSE values for Fig. 2 are shown in Table 1.



(a) Original Image (b) Effect of Speckle Noise



(c) Effect of Salt & Pepper Noise (d) Effect of Gaussian Noise

Fig. 3 . Second Case (Bag Image)

The PSNR and MSE values for Fig. 3 are shown in Table 1.

TABLE 1

S . N o .	Image Name	Speckle (S)		Salt and Pepper (S&P)		Gaussian (G)	
		PSNR	MSE	PSNR	MSE	PSNR	MSE
1	GRV	35.0	20.3	34.3	23.9	30.5	58.7
2	Raushan	34.9	21.1	35.0	20.9	30.2	62.8
3	Gunjan	34.8	21.3	35.1	20.2	30.1	63.1
4	Varun	34.6	21.9	35.2	19.9	30.1	62.6
5	Bag	34.9	21.0	34.8	21.5	30.1	63.3

#### V. CONCLUSION

The estimation of different image quality metrics ( PSNR,SNR,MSE) is essential task in digital image processing as it provides a better way for image quality assessment and its improvement. It can be observed that higher the value of PSNR and lower value of MSE are desired results. From the above obtained results, it can be concluded that image quality assessment is a difficult task as the value of PSNR and MSE for different test images are not satisfactory as desired and this field still needs lot of hard work for development of accurate image quality metrics.

#### VI. FUTURE SCOPE

The PSNR and MSE are good metrics for image quality assessment but not accurate as desired. Still there is need for better technique for getting improved value of PSNR and MSE and also other image quality assessment metrics for digital image processing.

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