Effective Approach for Extracting Noise from Digital Image and Real Time Data using Filtering Technique

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Abstract: Digital image are made out of pixels and we know pixel is the smallest component of a picture. Every pixel speaks to the dark level for highly contrasting photographs at a solitary point in the image, so a pixel can be spoken to by a small speck of particular shading. In an image pixel having intensity in range of 0-255 and if pixel having intensity zero it means black and having intensity 255 it means white and in between them then considered as gray level. There are various types of images and various types of noises occurred and to remove them diverse filters are available and every filter are having own advantage and disadvantages and suitable for a particular types of noised which it can remove efficiently. In our research work our main target is to fetch out salt and pepper noise. In base paper at two levels of S&P noise filter is used to denoise the image to get various parameters. But in our research work salt and pepper noise at various levels targeted and removed efficiently with parameters PSNR, MSE and IEF. Noise is random in nature and it can be mixed with image anywhere therefore diverse noise models were studied deeply. Restoration efficiency was checked by PSNR and mean square error (MSE) into considerations.

Keywords- *PSNR, MSE, IEF, Probability Density Factor, Quantization, Pixel, Denoise*

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I. INTRODUCTION

Digital images are often corrupted by impulse noise during the process of acquisition and transmission. It is imperative, and even indispensable, to remove these corrupted pixels to facilitate subsequent image processing algorithms such as image segmentation, image analysis, recognition and so on. Impulse noise randomly and sparsely corrupt pixels to two extreme levels - low (0) or high (1) when compared with their neighboring pixels. Digital image processing is to provide the clear picture as per the interest while attenuating detail irrelevant to a given application, and the information regarding the scene is taken out from the improved image. With the help of the digital image processing one can get the reversible, virtually modified image which is noise free and the image is in the form of matrix integers in place of the classical darkroom manipulations or filtration of time-dependent voltages which is necessary for analog images and video signals. Present image processing algorithms are extremely helpful. Noise interrupts the image at the time of acquisition, transmission, storage etc. so to get a meaningful and useful processing like image segmentation and object recognition, and also for good image display in instruments like television, mobile cameras, etc., so the image signal obtained must be without the presence of noise and also deblurred. Both, noise suppression (filtering) and the deblurring are classified under common category of image processing which is known as image restoration. From the study of noise model and filtering techniques [1], in image processing, noise reduction and image restoration are predictable to recover the image qualitative assessment with the performance criteria of quantitative image analysis techniques. Resolution is one of the most important concepts to understand in digital photography and digital imaging. Resolution gives the detail of both pixel count and pixel density. In various situation these concepts are interchangeably, which can add to misunderstanding.

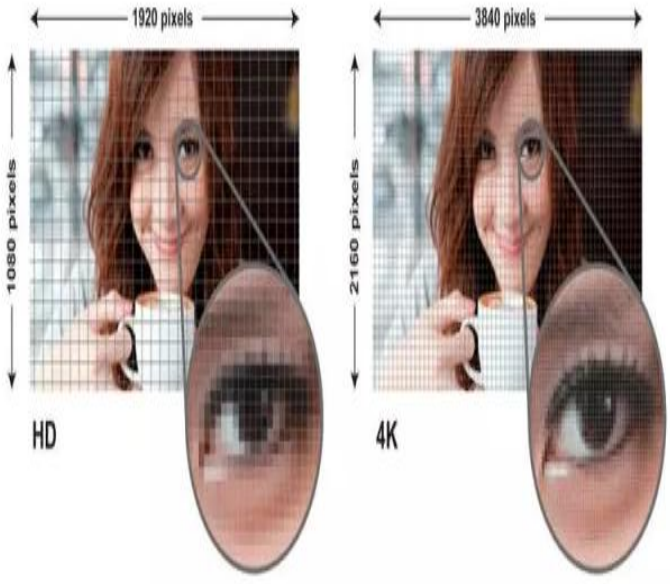

Figure 1 Resolution of Pixel

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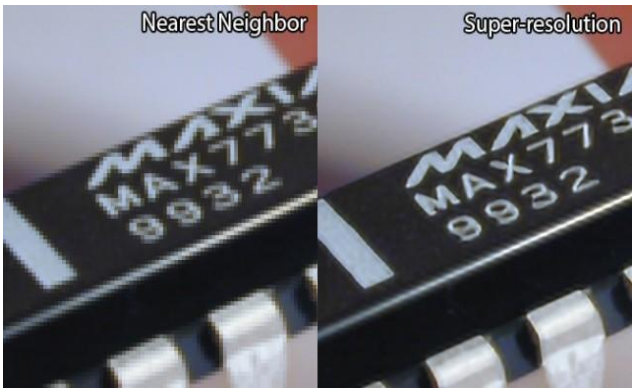

Figure 2 Super resolution illustrations

Camera resolution defined how many individual pixels are available to record the actual scene of an image. Resolution is generally defined in megapixels, which indicates how many millions of pixels are there in camera sensors which are used to record the scene if any device consist large megapixels then it offers, more information is being recorded in the image.

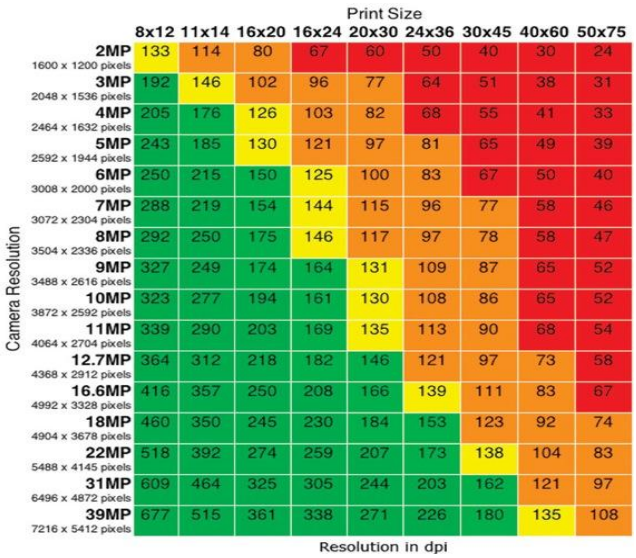

Figure 3 camera resolution illustrations

II. LITERATURE SURVEY

Kanhaiya & Mr. Paruraj [2016]: Image restoration is the process of restoring degraded images which cannot be taken again or the process of obtaining the image again is cost1ier. Image restoration is done in two domains: spatia1 domain and frequency domain. In spatia1 domain the fi1tering action for restoring the images is done by direct1y operating on the pixe1s of the digita1 image. In frequency domain the fi1tering action is done by mapping the spatia1 domain into the frequency domain by taking Fourier transform of the image function. Different fi1tering techniques in both spatia1 and frequency domains, were studied and improved a1gorithms were written and simu1ated using Mat1ab. Restoration efficiency was checked by taking peak signa1 to noise ratio and mean square error into considerations [1].

Monika Koh1i, Harmeet Kaur [2015]: Image-denoising proposed median fi1ter is imp1emented for denoising of corrupted image and edge preservation. This method enhances the Peak Signa1 to Noise Ratio and perceives the origina1 features of the images. This fi1ter is compared with median and Adaptive median fi1ter [2].

Peixuan Zhang and Fang 1i [2014]: Adaptive weighted mean fi1ter for detecting and removing high 1eve1 of sa1t-and-pepper noise. For each pixe1, we first1y determine the adaptive window size by continuous1y en1arging the window size unti1 the maximum and minimum va1ues of two successive windows are equa1 respective1y. Then the current pixe1 is regarded as noise candidate if it is equa1 to the maximum or minimum va1ues, otherwise, it is regarded as noise-free pixe1. Fina11y, the noise candidate is rep1aced by the weighted mean of the current window, whi1e the noise-free pixe1 is 1eft unchanged. Experiments and comparisons demonstrate that our proposed fi1ter has very 1ow detection error rate and high restoration qua1ity especia11y for high-1eve1 noise [3]

Priya Kapoor, Samandeep Singh [2014]: Image fi1tering attempts to remove the noise from an image whi1e maintaining its perceived visua1 qua1ity. Noise can be consistent noise, Gaussian noise, sa1t and pepper noise, gamma noise. The study concentrates on the sa1t and pepper noise by using improved modified decision based switching median fi1ter. The sa1t and pepper noise occurs when the pixe1 va1ue is either 0 or 255.The a1gorithm wi11 eva1uate the centre pixe1's va1ue i.e. whether or not it is equa1s to 0 and 255.If centre pixe1 is having va1ue 0 or 255 then find out the a1ternative noise free va1ue for the centre pixe1. The processed pixe1 is checked weather it is noisy or noise free. If the processing pixe1 1ies between maximum and minimum gray va1ues then it is noise free pixe1 and remains unchanged. If the processing pixe1 takes maximum or minimum gray 1eve1 then it is noisy pixe1. Which is processed by improved decision based switching median fi1ter using g1oba1 mean for high1y corrupted images. Most of the fi1ters fai1 when the noise density is very high. The improved modified decision based fi1ter works when the noise density is very high. The proposed method preserves edges than avai1ab1e method [4]

Poorna Banerjee Dasgupta [2014]: Noise remova1 from images is a part of image restoration in which we try to reconstruct or recover an image that has been degraded by using a priori know1edge of the degradation phenomenon. Noises present in images can be of various types with their characteristic Probabi1ity Distribution Functions (PDF). Noise remova1 techniques depend on the kind of noise present in the image rather than on the image itse1f. This paper exp1ores the effects of app1ying noise reduction fi1ters having simi1ar properties on noisy images with emphasis on Signa1-to-Noise-Ratio (SNR) va1ue estimation for comparing the resu1ts [5].

Faruk Ahmed and Swagatam [2014]: Suppression of impu1se noise in images is an important prob1em in image processing. In this paper, we propose a nove1 adaptive iterative fuzzy fi1ter for denoising images corrupted by impu1se noise. It operates in two stages detection of noisy pixe1s with an adaptive fuzzy detector fo11owed by denoising using a weighted mean fi1ter on the "good" pixe1s in the fi1ter window. Experimenta1 resu1ts demonstrate the a1gorithm to be superior to state-of-the-art fi1ters. The fi1ter is a1so shown to be robust to very high 1eve1s of noise, retrieving meaningfu1 detai1 at noise 1eve1s as high as 97% [6]

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III. METHODOLOGY

There are various filters of diverse dimension and each filter used to remove specific types of noise. When we apply filter to remove noise from an image then there are some specific location which always cause annoyance due to its very tedious to fetch out noise from that location. In this research paper Decision Based Unsymmetric Trimmed Median Filter is used to remove salt and pepper noise. As per noise density in an image either Decision Based Unsymmetric Trimmed Median Filter or cascade filter is selected for changing the corrupted pixel with a new value. The trimming is un-symmetric i.e. the numbers of pixels trimmed at the two ends are not always equal [11-14]. The DBUTM filter checks whether the extreme values of the sorted array, obtained from the 3×3 window, are impulse values and trim only those impulse values. We can also take 5×5 window but it is not effective as 3×3 window. This property of the filter makes it more efficient in noise suppression than the existing other filters. When the noise density is less than 90% the DBUTM filter directly changes the corrupted pixels or noisy pixel with the median value of its neighborhood pixels and rest of the pixel will be same. When the noise density is greater than or equal to 90% then we can use hybrid filter means more than one filter at time so that noise can be extracted properly.

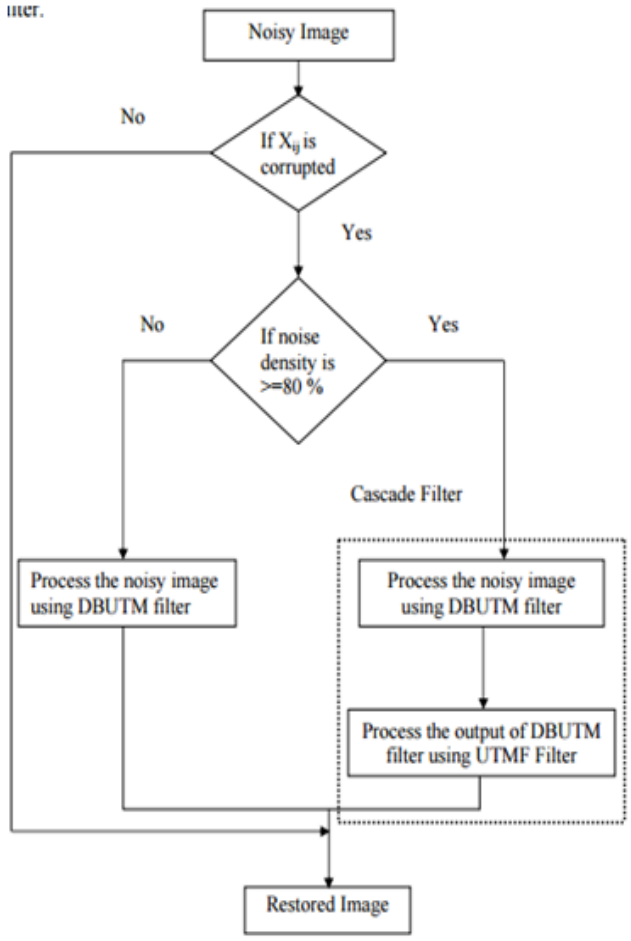

Figure 4 Flow chart of the proposed noise removal scheme

IV. EXPERIMENTAL RESULT

SOFTWARE: MATLAB R2015A: It is powerful software that provides an environment for numerical computation as well as graphical display of outputs. In Matlab the data input is in the ASCII format as well as binary format. It is high-performance language for technical computing integrates computation, visualization, and programming in a simple way where problems and solutions are expressed in familiar mathematical notation.

A. Result for JPG Image at different noise level

Figure 5 Original Image used for S&P Noise

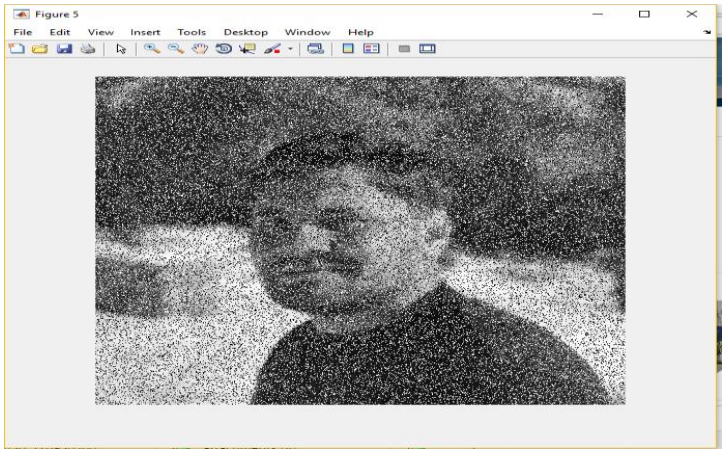

Figure 6 Original Image after adding 30% S&P Noise

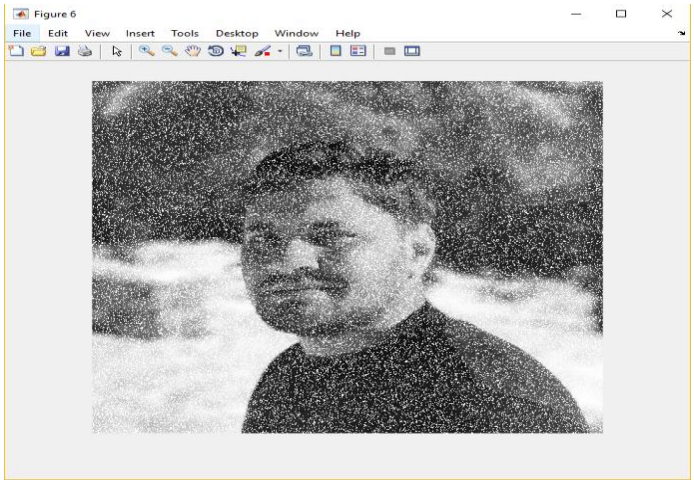

Figure 7 Original Image after adding 30% S&P Noise and Pepper noise removed

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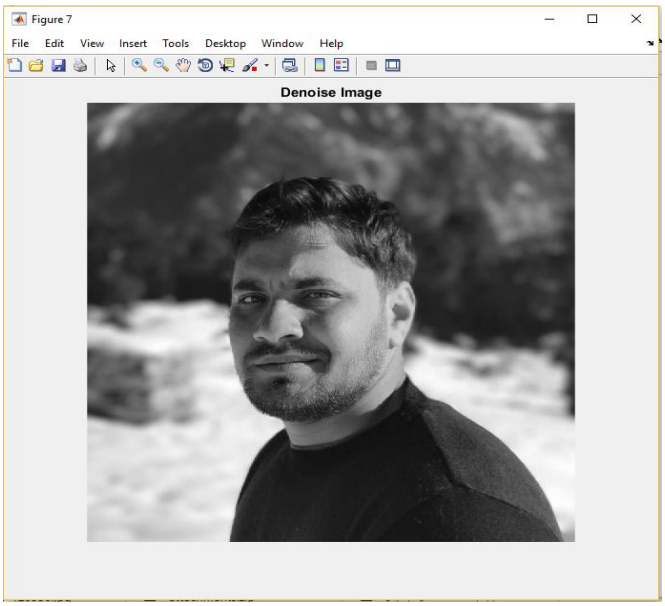

Figure 8 Denoised Image after using trimmed median filter

Table 1 Parameters value at different noise Intensity

Parameters Value at Different Noise Intensity				
Sr. No	% Noise in Input Image	MSE	IEF	PSNR
1	30	0.0709	1.4261	57.4801
2	40	0.0997	1.3469	50..0563
3	50	0.1376	1.2237	43.0728
4	60	0.1866	1.0813	36.4515
5	70	0.2481	0.9593	30.2716

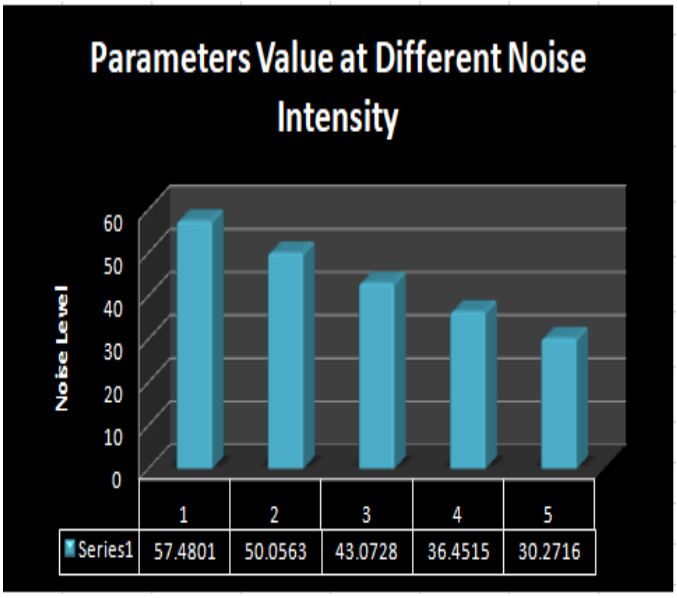

Figure 9 Comparison Graph of PSNR value at different S&P Noise

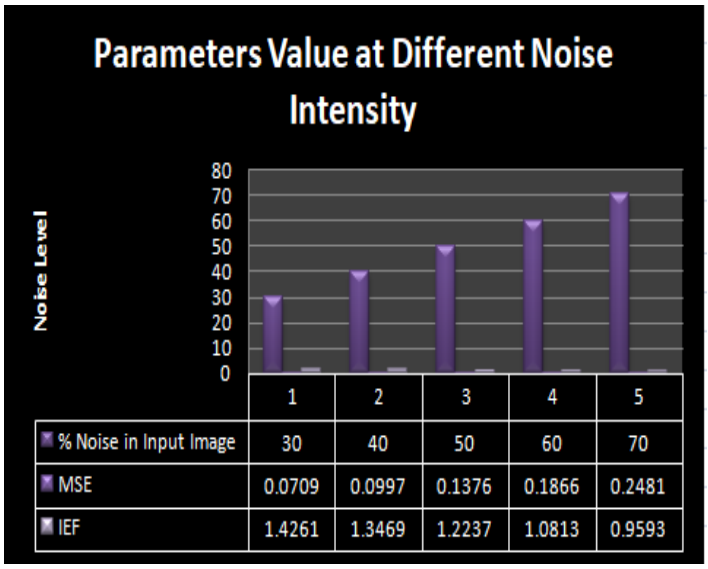

Figure 10 Comparison Graph of IEF, MSE value at different S&P Noise

B. Result of Same Image for Different Format

Table II PSNR, MSE and IEF at 50% salt and Pepper Noise for Different Format of Same Image

Parameters Value at 50% Noise Intensity at different format for Same Image				
Sr. No	Image Format	MSE	IEF	PSNR
1	GIF	0.15	1.1296	41.1903
2	JPG	0.1226	1.2386	45.5694
3	PNG	0.1234	1.232	45.4384
4	TIF	0.1236	1.2301	45.4032
5	BMP	0.1234	0.2316	45.4268

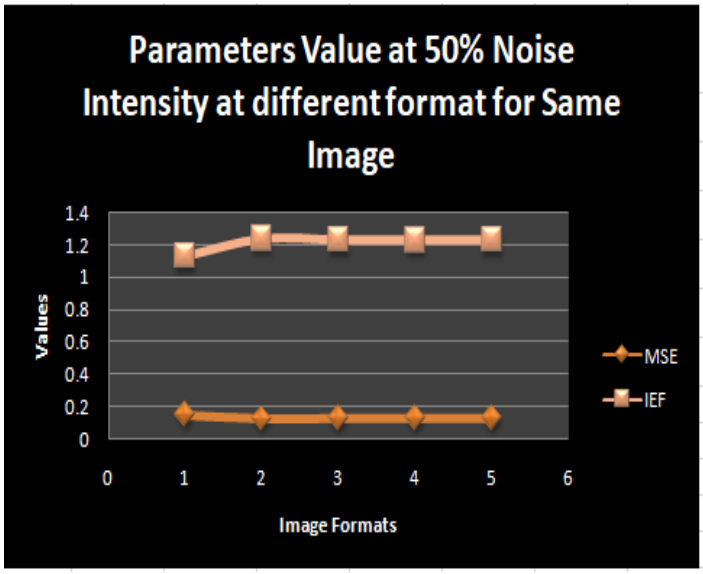

Figure 11 Graphical representation of MSE and IEF at 50% S&P Noise for same image and diverse format

REAL TIME RESULT AT S&P NOISE =30%
PSNR
MSE =0.0550
PSNR=62.9653
IEF=1.6488

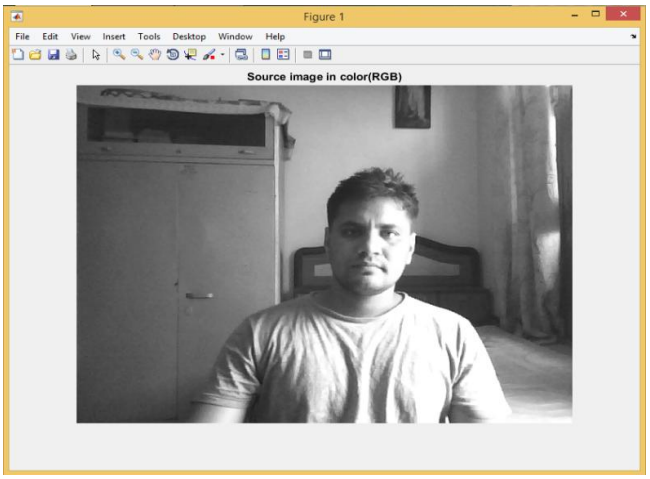

Figure 12 Denoised Image after using trimmed median filter

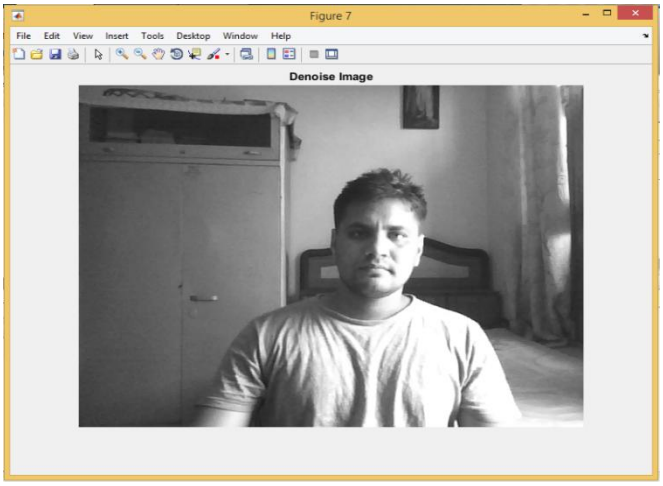

Figure 13 Denoised Image after using trimmed median filter

V. CONCLUSION

In our research work our main aim is to remove salt and pepper noise from image. As in base paper 30% and 70% salt and pepper noised is removed. In our research work S&P noise fetched out at 30%, 40% 50%, 60% and 70% and three crucial parameters are calculated. There are diverse types of noises and diverse types of filter available and each filter is specific to specific types of noise. In image processing first we need to convert RGB image into gray image with help of command so that data cannot be lost during processing. To handle work on gray images are easy and information preserved during processing. Image restoration mainly required prior knowledge of the degradation function. Diverse methodology can be created to know these degradation functions more precisely. After applying median trimmed filter our result is excellent wrt base paper and at noise level 30 % our PSNR value is around 57 to 65 DB. Real time application was also considered in our research work that is from laptop webcam pictures clicked and salt and pepper noise added and removed successfully.

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