Gray Level Co-Occurrence Matrix for the PNLM Filtering

Kanika Sharma[1], Vishal Kalra[2]
[1]*Research Scholar, GNI Mullana, Haryana, India*
[2]*Assistant Professor, GNI Mullana, Haryana, India*

Abstract - The MRI images are the medical images which have the raisian image. The noise pixels are the extra pixels on the image which reduce its quality. The NLM filter is the filtering technique which can denoise the MRI images. The PNLM filter is the improved version of NLM filter which can denoise the image more efficiently. In this research work, the PNLM filtering technique is improved using the GLCM algorithm. In the proposed improvement the window size will be defined dynamically which improve PSNR and MSE values. The proposed algorithm is implemented in MATLAB and results shows that proposed algorithm performs well as terms of certain parameters

Keywords - PNLM, NLM, GLCM, MRI

I. INTRODUCTION

Image Processing is a field in which an image is enhanced or important features from the image are extracted by performing some operations on it. An image is given as input and, either an enhanced De-noising method mage or some characteristics of that image are received as output. Analog and digital image processing are the two different types of methods performed in this field [1]. The manipulation of digital images using computers is known as digital image processing. Pre-processing, enhancement and information extraction are the three basic phases performed on any kind of data being processed in this field. Cameras, video cards, and scanners are the very basic devices that capture images from different sources. Enhancing the contrast, identifying edges, quantifying the intensity and applying several other mathematical operations to the images are some of the operations performed by image processing by ensuring a minimal cost investment [2]. Adjusting the spatial resolutions of everyday images from cameras or increasing the brightness of photos is not the only tasks of image processing. There are large numbers of applications that include image processing in them. Tracking of moving objects, remote sensing, Intelligent Transportation Systems, Biomedical Imaging, and Automatic Visual Inspection are few of the famous applications of image processing [3]. Magnetic resonance imaging (MRI) is defined as the process in which images are generated from the raw data directly after which it is sampled in the spatial frequency domain. In order to sample the 3D spatial frequency volume there are various procedures to be followed such as 3D radial spokes trajectory similar to a kooshball. There are different types of essential undersampling in which aliasing artifacts is not used in comparison with minimum sampling density proposed by the Shannon-Nyquist sampling theorem this is the benefit of using this strategy. In comparison to all the other existing medical modalities, the MRI technology has proven to be the most effective and the least harmful for patients. Particularly the soft tissues of brain and muscles can be viewed very accurately through MRI [4]. Several abnormal conditions such as tumor, internal injuries, cancer and so on can be diagnosed through this scan. It is considered as non-invasive since it does not require ionizing radiation [5]. Amongst the normal and diseased tissues, an excellent contrast is provided through MRI technique. Image denoising is defined as the process in which noise is removed from an image as it corrupts all the features of an image during the process of acquisition or transmission in maintaining the quality of an image. This process is the sub part of digital image processing. In the medical field, disease diagnosis at the early stage is necessary for which most commonly used tool has been utilized such as MRI for the analysis of medical image. During the process of image acquisition, random noise affects the images quality and provides the undesirable results and bad visual quality of an image due to which visibility of low contrast objects is lowered [6]. The extraction of the hidden details, data of an image and to recover the fine details removal of noise from an image is essential in the applications of medical imaging. There is affect in the process of medical diagnosis due to these corrupted MR images with noise. Generally, there are various techniques used to remove the noise from an image and major area for the researchers. In the denoised MR images various tools are implemented proposed previously. However, it is required that process of noise suppression not affect the quality of an image and not degrade the useful features of an image. In the MR images an essential role is played by the edges, therefore it is required to preserve the edges to balance the denoising. Non Local means (NLM) filter is proposed by Buades. In order to remove noise form an image there are various types of denoising methods that has been utilized in which local pixels are considered within a small neighbor [7]. The small structures are considered as the noise and removed from an image while large scale structures are preserved. There is redundancy of information present within the images that need to be removed the noise from an

image using the NLM filter. The weighted average of all the voxel intensities within the image due to which stored intensity value of the voxel is calculated.

II. LITERATURE REVIEW

Jannath Firthouse.P, et.al (2016) presented the major challenge faced by the researchers is the Image Denoising [8]. They performed undergo a contourlet domain for decomposition of input images in order to denoise Gaussian noises and Speckle noises in the MRI images for this work. In order to preserve the edges and contours, they utilized the above mentioned method for preservation. They implemented threshold methods in this paper after decomposition process such as Bayes Shrink, Neigh Shrink, and Block Shirnk with the help of which noise effects are minimized at the greater extent. Therefore, to ensure that improvement has been achieved by proposed method, various parametric values are calculated.

FarhaFatina Wahid, et.al (2017) presented in the field of medical imaging modality, the Magnetic Resonance Imaging (MRI) is the commonly used technology [9]. The major topic nowadays is the fusion of two or more denoising algorithms. The combination of the concept of the local and non-local filtering in MRI images or the fusion of two well-known denoising approaches is the main focused of this paper. They implemented the local fuzzy filter and the basic Non Local Means filter (NLM) in this paper. They also utilized the Non Subsampled Contourlet Transform (NSCT) for the fusion of two approaches in the transform image. This is done for the denoising a set of MRI images corrupted with additive noise. Experiments were done in order to evaluate the performance of proposed method. The obtained results concluded the effectiveness of the proposed method as compared to other methods.

A.G. Rudnitskii, et.al (2017) presented in the process of medical diagnosis the emerging technology of noninvasive has been widely utilized called as the Magnetic Resonance Imaging (MRI) [10]. This is the other some other process such as segmentation, reconstruction and registration are considers as complicated for the process of image analysis. Therefore, noise reduction is considered as the pre-processing task before going to image analysis in MR images. The sufficient understanding for complex objects has been provided by the two dimensional (2D) imaging. Therefore, the representation of many real objects in 3D computer is necessary. They developed the denoising and segmentation techniques in this paper for the development of 3D MRI based on fractal and morphological approaches.

R. Sujitha, et.al (2017) presented an essential role is played by the image denoising in the field of medical image processing in the diagnosis process. The major issue faced by the researchers, is the removal of noise from the original signal. there are various methods has been proposed so far such as denoising techniques each technique has its own merits and demerits [11]. In the process of medical diagnosis, this proposed technique has been utilized. There if enhancement in the quality and clinical parameter of an image due to denoising of these images also used in the research area. They proposed a wavelet-based thresholding scheme in this paper for image denoising and noise suppression in MRI images. For analyzing the performance level of proposed approach few parametric values are calculated.

Hanafy M. Ali, et.al (2017) presented the emerging technology of Magnetic Resonance Imaging (MRI) in the field of medical imaging with the help of which high precision images can be obtained from human brain. The MRI technique is applied for monitoring the various organs of human body. The scanned images achieved include several types of noises in them that affect the quality of those images [12]. They modified a median filter algorithm in this paper. In the MRI image, there are different types of noises are added mentioned above in this paper. In order to remove the additive noises from the MRI images, they utilized the filters in this paper. In order to compare the performance and for the evaluation of filters, they added the noise density to the MRI image. They performed experiments on the proposed method and evaluated the performance of these filters in comparison with others methods in terms of Peak Signal-to-Noise Ratio (PSNR) and so on.

DongshengJianga, et.al (2018) presented the major importance of improving the quality of acquired image can be done by performing the task of denoising of magnetic resonance (MR) images. They proposed an enoising MRI Rician noise approach using a convolutional neural network [13]. They also proposed the combination of ten convolutional layers neural network with residual learning and multi-channel. Experiments were performed on the synthetic and real 3D MR data for the evaluation of proposed method. The obtained results show the effectiveness of the proposed method as compared to other methods in terms of peak signal to noise ratio and the global of structure similarity index. The proposed method will work well if there is no noise level parameter in comparison with methods in two datasets. Therefore, good general applicability showed by the proposed method.

III. RESEARCH METHODOLOGY

NLM is the filtering technique used to de-noising the MRI images. The qualities of MRI images are greatly affected by the presence of raisin inside the images. The PNLM is the improvised form of NLM algorithm which processes the

parallel pixels by de-noising the images to have a better experience. Further, another algorithm is proposed to have better and satisfactory performance is the GLCM algorithm. This approach is used to determine the Peak signal-to-Noise Relation (PSNR), Mean Square Error (MSE) and Mean Structural Similarity Index (MSSIM). Here, GLCM is abbreviated as Grey level Co-occurrence Matrix and also called Grey Tone Spatial Dependency Matrix. In this, the number of rows is equal to the number of columns to the total number of grey levels present within the images. It is in the table form and determines different combination brightness values falling in any image. The main objective of GLCM is to extract statistical surface parameters like Inverse Difference Moment, Entropy, Angular Second Moment and Correlation. The second order statistical information is another component of the GLCM algorithm which joins the pixels of the images. This second order statistical information focuses on the implementation of this GLCM in VERILOG language. GLCM is also used in the evaluation process of grey co-matrix in the scaled format. Let us suppose that 'I' is the binary image in grey co-matrix scaled format and if 'I' is the intensity image which divides the image into eight grey-levels. The numbers of these grey levels are specified by the 'Numlevels' and gray co-matrix divides the different values by using 'Graylimits' parametric values.

Pseudo Code of GLCM Algorithm

1. Number of pixels is counted which used to save the data.

2. The counted pixels are stored in the matrix P[I,j].

3. The similarity is verified by applying the histogram technique.

4. The contrast factor is calculated by using following expression:

$$g = \exp[\frac{mean(I) - minimum(I)}{maximum(I) - mean(I)}]$$

5. The values of g are normalized by dividing them by number of pixels.

$$g = \begin{bmatrix} 0.8\ if g < 0.8 \\ 1.2\ if g > 1.2 \\ g otherwise \end{bmatrix}$$

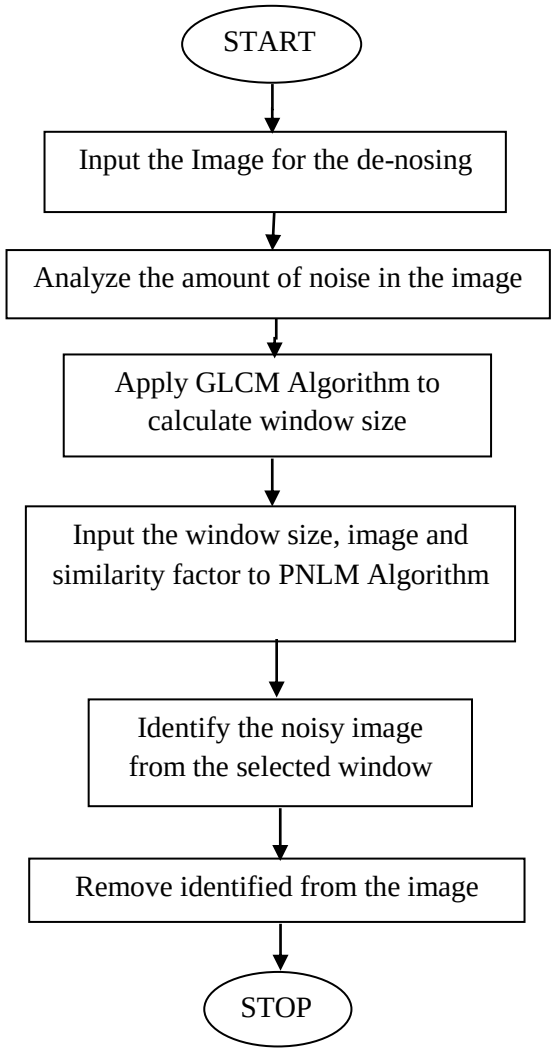

Figure 1: Proposed Flowchart

IV. EXPERIMENTAL RESULTS

The proposed work is implemented in MATLAB and the results achieved are compared with existing work to evaluate the performance results in terms of several parametric values.

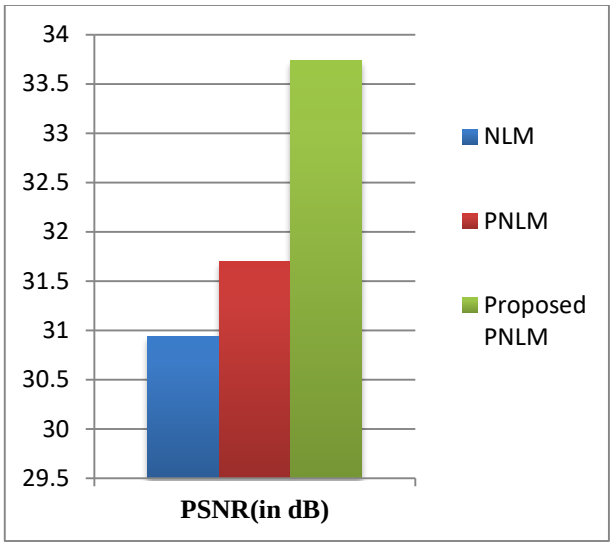

Figure 2: PSNR Comparison

As shown in figure 2 the PSNR value of different images is compare between the proposed, NLM and PNLM algorithm. It is analyzed that proposed algorithm has maximum value as compared to other algorithm like NLM and PNLM.

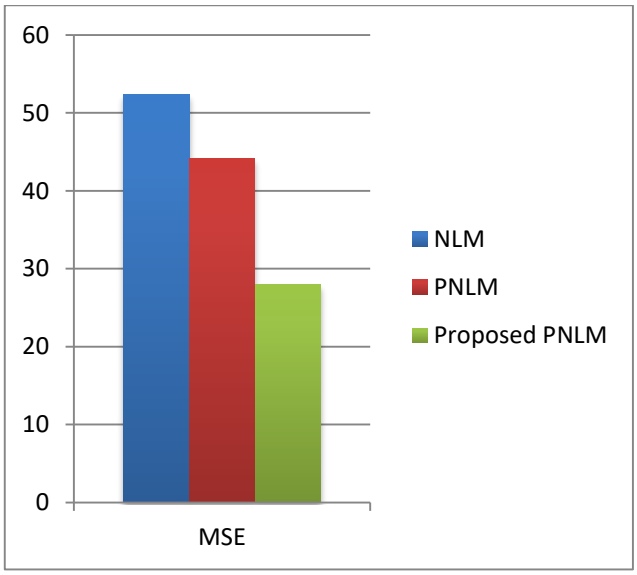

Figure 3: MSE Comparisons

As shown in figure 3, the Average value of MSE of the NLM, PNLM and Proposed algorithm is compared for the performance analysis. The graphical representation is shown in the figure in which Proposed algorithm has least MSE as compared to other algorithms.

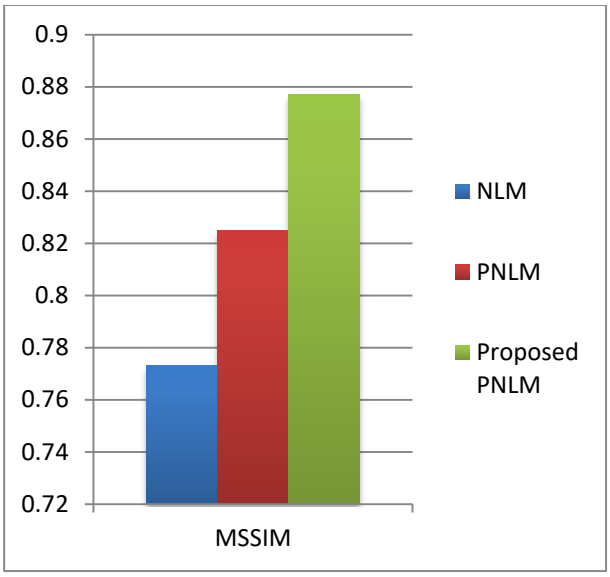

Figure 4: MSSIM Comparison

As shown in figure 4, the MSSIM value of the Proposed algorithm, NLM and PNLM algorithm is compared for the performance analysis. The MSSIM value of the proposed algorithm is higher as compared to existing algorithms.

V. CONCLUSION

In our proposed work, a comparison is made between the filtering techniques. The latest technique is proposed for the denoising of the MRI images which contains raisin noises. The improved version of NLM that is PNLM is used. In the proposed NLM filtering approach images are captured and considers as a input and from this noises levels are estimated from the captured MRI images. The NLM filtering is used to study similarity of the pixels present within the window size and removes the pixels those pixels which don't have same size. The removed pixels are called residual pixels. In these two steps, the size of window is changed as per the input provided by the GLCM algorithm and analyzes the results on the basis of PSNR, MSE and MSSIM values. The results of NLM, PNLM and two step algorithms are compared on different images and found that the two step algorithm performs in more satisfactory manner and illuminates the noises from the pixels which in turn increase the value of residue.

VI. REFERENCES

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