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Review On: De-Noising Medical Images by Low Rank Matrix Decomposition, NN and SVM

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Abstract: *Medical imaging technology is becoming an important component of larger number of applications such as diagnosis, research and treatment. Medical images like X-Ray, MRI, PET and CT have minute to minute information about brain and whole body. So the images should be accurate and free of noise. Noise reduction plays the necessary role in medical imaging. There are various methods of noise removal like filters, wavelets and thresholding. These methods produced good results but still have some drawbacks. The limitations of the previous methods are considering and analyzing this research and the new proposed technique presents neural networks and SVM as an efficient tool for rician noise reduction. The proposed method gives more clear image with higher PSNR and improved SSIM value than the previous methods. In this paper, the techniques used for proposed work are discussed.*

Keywords: *Image denoising, Rician noise PSNR,MSE, Neural Networks , SVM.*

I. INTRODUCTION

Medical image enhancement: *The* arrival of digital medical imaging technologies like Positron emission tomography, Medical Resonance Imaging, Computerized tomography and Ultrasound Imaging has revolutionized modern medicine. Many patients no longer need to go through dangerous procedures to diagnose a wide variety of diseases. Because of increased use of digital imaging in medicine today the quality of digital medical images becomes an important issue and to achieve the best possible diagnosis it is important for medical images to be sharp, highlight, clear, and free of noise. While these technologies are needed in acquiring digital medical images continue to improve and resulting in images of higher resolution and quality but removal of noise in these digital images remains one of the major challenges in the study of medical imaging because they could mask and blur important features in the images and many proposed de-Noising techniques have their own problems. Image de-noising still remains a challenging problem for researchers to noise removal which is introduces through artifacts and causes to blurring of the images. The factors which affect noise modeling in medical imaging are capturing instruments, information transmission media, image quantization and separate sources of radiation. So different algorithms are used depending on the noise model that is why it is important to reduce noise and other artifacts in images , as various types of noise generated reduces the effectiveness of medical image diagnosis.

Low-Rank Matrix Decomposition

It has been derived from com-pressed sensing theory which has been successfully applied various matrix completion problems, such as image compression, video denoising and dynamic MRI. These have been compared with classical denoising methods. Denoising methods are also based on low rank completion enforce to fewer external assumptions which has been taken to noise distribution. These methods provides information on the self-similarity of three dimensions (3-D) images across various slices or frames which construct a low rank matrix for better performance. Now days, it has significantly variations to varying contents between other slices or frames may lead high level exception to the assumption of low dimensional rank in 3-D images, and discount the effectiveness of these methods for further utilization. The concept to denoising of entire coil image can be accomplished through sliding the patch across process image in a raster fashion techniques. Thus, each pixel is calculated repeatedly to overcome overlapping patches and obtains multiple estimations results. The final output of each pixel describes which is calculated by taken simply averaging of all estimates values of current pixel from overlapping patches.

Artificial Neural Networks

Artificial neural networks are massively interconnected networks in parallel of simple elements (usually adaptable) with hierarchic organization, which attempt to interact with the objects of the real world in the same way that the biological nervous system does. Artificial neural networks can be used for any purpose either to gain an understanding of biological neural networks or to solving artificial intelligence problems without creating a model of a real time biological system. The real biological system is incredibly complicated. Artificial neural network algorithms try to abstract this complexity and focus on what matters most from an information processing point of view. Artificial neural networks typically begin with some randomized weights optimizations for all their neurons. This implies that they do not recognize anything to any purpose and it is necessary to trained for solve the particular problem which they are supposed. Broadly there are two strategies for training associate ANN, depending on the matter it should solve.

A simple self-organizing artificial neural network is considered to huge amounts of data and applies to discover patterns and relationships in information analysis. Researchers typically use this kind to investigate experimental data.

A more famous back-propagation artificial neural network is assumed to train by humans to perform specific different tasks. This kind of task is used for psychological research and for problem-solving applications.

Support Vector Machine (SVM)

It is primarily a classifier in which width of the margin between the classes is the optimization criterion, i.e. empty area around the decision boundary defined by the distance to the nearest training patterns. These are called support vectors.. The concept of Support Vector Machine was designed by Vapnik. The main objective of any machine provides a capability of learning which can be achieved through good generalization and performance; it has provided a finite amount of training data. The support vector machines have marked to achieve good generalization performance with no need of prior knowledge of the data. The principle of an SVM is proposed to map the input data onto higher dimensional features in spacing nonlinearly related to the input space and determine a separating hyper plane with maximum margin between the two classes in different feature space. The SVM is a maximal margin hyper plane for feature space to build a kernel function. This results in a nonlinear boundary in the data space. The optimal separating hyper plane can be useful to determine any computations in the higher dimensional feature space which is using kernel functions in the input space.

This has two advantages:

(1) The ability to come up with non-linear decision representation.

(2) The use of kernel function allows the user to apply a classifier to data that have no fixed dimensional vector space representation.

There are some commonly used kernels that include:

(a) Linear kernel K(x,y)= x,y

(b) Polynomial Kernel

$$K(x,y)= (x , y+1) d$$

SVM Algorithm

Define an optimal hyper plane.

i. Extend the above definition for non liner separable problems.
ii. Map data to high dimensional space where it is easier to classify with linear decision surfaces.

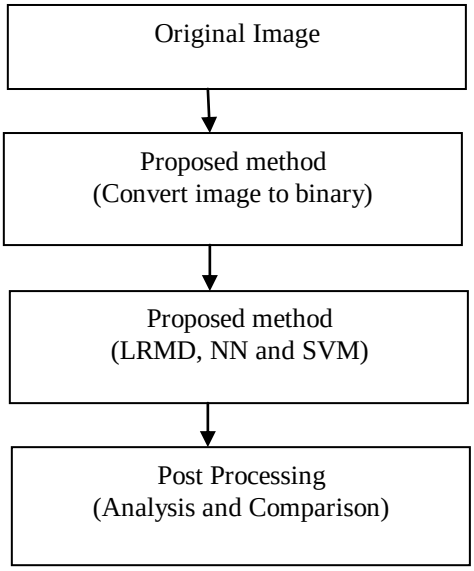

Figure: Block diagram of proposed system

II. RICIAN NOISE

Rician noise degrades images in both qualitative and quantitative senses, interpretation and feature detection. The bias due to rician noise reduces delectability in low SNR MRI. Consequently, it is highly desirable to develop filtering methods that remove this noise. The rician noise can be estimated from the image and a simple correction scheme is provided to reduce the bias. Rician noise introduces some bias information into MRI measurements that can have a significant role in impact

to provide the shapes and orientations of tensors in diffusion tensor magnetic resonance images. This is the latest problem in structural MRI, because this bias is the signal dependent and it does not seriously impair tissue identification or clinical diagnosis.

EFFECTS OF RICIAN NOISE:

1. The rician noise is significant impact on the shapes and orientations of tensors in diffusion tensor magnetic resonance images.

2. Due to rician noise images suffer from a contrast values and signal dependent bias.

III. RELATED WORK

Lin Xu et al. in 2014 [1] presented parallel magnetic resonance imaging (pMRI) methods can helpful to speed up MRI scan images through a multi-channel coil array to receiving signal simultaneously. The noise amplification and aliasing artifacts are more powerful and serious strategy in pMRI reconstructed images at high increasing velocities. This study presents a patch-wise denoising method for pMRI by exploiting the rank deficiency of multi-channel coil images and sparsity of artifacts. For every processed patch similar patches a researched in spatial domain and throughout all coil elements and arranged in suitable lattice structure. Then noise and aliasing artifacts can be removed from the structured matrix through applying sparse and low rank matrix decomposition technique for better construction of image. The proposed method has been validated using both phantom and in vivo brain data sets and producing encouraging results. The method can effectively remove both type noise and residual aliasing artifact from pMRI reconstructed noisy images and produce higher peak signal noise rate (PSNR) as well as structural similarity index matrix (SSIM) as compared to other state-of-the-art denoising methods. R.Riji, et al. presented iterative bilateral filter for rician noise reduction in MR images in 2014 [2], this filter the denoising efficiency and preserves the edge feature and fine structures in the images. It also removes the bias due to rician noise. In this paper PSNR and Mean structural similarity index matrix used to enhance and better quality of MR images. Abha Choubey, Dr. et al. presented a hybrid filtering method in medical image denoising in 2011 [3] that technique related to the Additive white Gaussian Noise from the CT images and provides the better quality of the CT images. This work is comprised of three steps such as - preprocessing, training and testing. In the preprocessing phase, hence, the denoised and the quality enhanced CT images are obtained in an effective manner.

IV. CONCLUSION

In this literature survey paper, we have proposed the neural networks and SVM on the basis of deep study. These proposed methods are less used in the field of research for image de-noising and enhancement. In our methodology we will use Low rank matrix decomposition and SVM. The evaluation of performance will be based on the PSNR and mean SSIM with their improved values. These new parameter has introduced mean square error (MSE), The proposed methodology will be improved technique for medical image de-noising using Neural networks. SVM will be exhibit outcomes for more noise reduction and image quality will increases through improvements with different noise levels.

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