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Efficient Analysis of MRI Image Denoising using different Type of filter

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Abstract

This paper proposes an efficient analysis of MRI Image Denoising using different type of filtering methods. The search for efficient image denoising methods is still a valid challenge at the crossing of functional analysis and statistics. Image denoising has become an essential exercise in medical imaging especially the MRI image. This paper proposes a medical image denoising algorithm using Wiener and Median filter. The presence of noise in biomedical images is a major challenge in image processing and analysis. Denoising techniques are aimed at removing noise or distortion from images while retaining the original quality of the image. These images have been converted into grayscale and three types of noises have been added, including Speckle, Gaussians, and Salt & Pepper. In brief, this project succeeds to explore a new thresholding method with better performance in both PSNR and MSE. It reveals that median filter is the best filtering method to remove the Speckle, Gaussians, and Salt & Pepper noise. But in this paper we also used the different type of the Shrinks for the best result. For the implementation of this proposed work we use the Image Processing Toolbox under Matlab Software.

Keywords: Wiener filter, median filter, MRI image, Speckle, Gaussians, and Salt & Pepper, PSNR, MSE and Shrinks.

Introduction

In the past two decades, many noise reduction techniques have been developed for removing noise and retaining edge details. Most of the standard algorithms use a defined filter window to estimate the local noise variance of a noise image and perform the individual unique filtering process. The result is generally a greatly reduced noise level in areas that are homogeneous. But the image is either blurred or over smoothed due to losses in detail in non-homogenous areas like edges or lines. This creates a barrier for sensing images to classify, interpret and analyze the image accurately especially in sensitive applications like medical field. The primary goal of noise reduction is to remove the noise without losing much detail contained in an image. To achieve this goal, we make use of a mathematical function known as the wavelet transform to localize an image into different frequency components or useful sub bands and effectively reduce the noise in the sub bands according to the local statistics within the bands. The main advantage of the wavelet transform is that the image fidelity after reconstruction is visually lossless. The wavelet de-noising scheme thresholds the wavelet coefficients arising from the wavelet transform. The wavelet transform yields a large number of small coefficients and a small number of large coefficients. Wavelets are especially well suited for studying non stationary signals and the most successful applications of wavelets have been in compression, detection and denoising.

Ultrasonic detection technology is a method provides the basis for discovery and diagnostics for diseases by measuring physiological tissue morphology and data which is applied to the human body detection. In actual clinical diagnostic applications, ultrasound imaging technology is collectively known as one of the four imaging technologies the field of modern medicine with X-ray, CT, and MRI, and it is a convenient, painless, intuitive, non-invasive important means of imaging techniques for medical analysis and diagnosis. Ultrasound image analysis of ultrasound-based diagnostic techniques become critical support for the clinical diagnosis and telemedicine technology because of its many advantages such as fast, wide range and timely diagnosis in the process of obtaining organic image, as well as disease diagnosis without danger and suffering, and it has important application status. The clinical diagnosis applications have high demands on the quality of ultrasound images. In order to provide ultrasound images as important diagnostic evidence for medical diagnosis, the search for more effective ways to remove noise in ultrasound images become a key issue. In the actual ultrasonic imaging process, as the ultrasonic transmitted from the

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emission source of the signal scattering inevitably when propagating to the deep tissues of the body organs, and the echo signals affect the imaging of ultrasound image, so multiplicative speckle noise formed in ultrasound images, interfering the detail features of the ultrasound image, thereby affecting the accuracy of medical diagnosis. Traditional de-noising method cannot effectively remove multiplicative speckle noise and ensure the detail features, result in lower accuracy of ultrasound image-based medical diagnosis.

In order to improve the effectiveness of medical MRI images denoising, the MRI image denoising method is proposed. Taking into account the effect of multiplicative speckle noise in the image detail features, directly rigid filtering of the image is avoided.

Lakhwinder Kaur, Savita Gupta, R.C. Chauhan Deptt. of CSE SLIET,[8] Longowal Punjab (148106), India ,"Image Denoising using Wavelet Thresholding", In This paper proposes an adaptive threshold estimation method for image denoising in the wavelet domain based on the generalized Gaussian distribution (GGD) modeling of sub-band coefficients. The proposed method called Normal Shrink is computationally more efficient and adaptive because the parameters required for estimating the threshold depend on sub-band data.

Iram Sami, Abhishek Thakur, Rajesh Kumar, [9] "Image Denoising for Gaussian Noise Reduction in Bionics Using DWT Technique", Image denoising has been achieved using new technique of wavelet transform in combination with Weiner filters and results have been obtained that could be measured subjectively by viewing the pictures of restored image attained as above results and checking the PSF of final restored image that shows very less distortion parameter. Also, Image quality has been measured objectively using MSE value with different wavelets.

Sachin D Ruikar, Department of Electronics and Telecommunication [10], "Wavelet Based Image Denoising Technique", In This paper proposes different approaches of wavelet based image denoising methods. The search for efficient image denoising methods is still a valid challenge at the crossing of functional analysis and statistics.

The remainder of this paper is organized as the following. At first, in Section II we illustrate the various components of our proposed technique to denoising. Further, in Section III we present some key experimental results and evaluate the performance of the proposed system. At the end we provide conclusion of the paper in Section IV and state some possible future work directions.

Proposed technique

This section illustrates the overall technique of our proposed Denoising of MRI images. In this paper, we proposed an efficient analysis of Ultrasound Image Denoising using different type of filtering methods. The primary goal of noise reduction is to remove the noise without losing much detail contained in an image. To achieve this goal, we make use of a mathematical function known as the wavelet transform to localize an image into different frequency components or useful sub bands and effectively reduce the noise in the sub bands according to the local statistics within the bands. The main advantage of the wavelet transform is that the image fidelity after reconstruction is visually lossless. The wavelet de-noising scheme thresholds the wavelet coefficients arising from the wavelet transform. The main improvements in our work are the using of the different type of the filters. We proposed an efficient analysis of Ultrasound Image Denoising using different type of filtering methods or Shrinkages. In this we used different types of shrinkage:

A. Wiener Filter
B. Median Filter

A Wiener Filter

In signal processing, the Wiener filter is a filter used to produce an estimate of a desired or target random process by linear time-invariant filtering an observed noisy process, assuming known stationary signal and noise spectra, and additive noise. The Wiener filter minimizes the mean square error between the estimated random process and the desired process. The most important technique for removal of blur in images due to linear motion or unfocussed optics is the Wiener filter. From a signal processing standpoint, blurring due to linear motion in a photograph is the result of poor sampling. Each pixel in a digital representation of the photograph should represent the intensity of a single stationary point in front of the camera.

B Median Filter

Median filtering is a nonlinear process useful in reducing impulsive or salt-and-pepper noise. It is also useful in preserving edges in an image while reducing random noise. Impulsive or salt-and pepper noise can occur due to a random bit error in a communication channel. In a median filter, a window slides along the image, and the median intensity value of the pixels within the window becomes the output intensity of the pixel being processed. The median filter is normally used to reduce noise in an image, somewhat like the

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mean filter. However, it often does a better job than the mean filter of preserving useful detail in the image.

How It Works

Like the mean filter, the median filter considers each pixel in the image in turn and looks at its nearby neighbors to decide whether or not it is representative of its surroundings. Instead of simply replacing the pixel value with the *mean* of neighboring pixel values, it replaces it with the *median* of those values. The median is calculated by first sorting all the pixel values from the surrounding neighborhood into numerical order and then replacing the pixel being considered with the middle pixel value. (If the neighborhood under consideration contains an even number of pixels, the average of the two middle pixel values is used.) In signal processing, it is often desirable to be able to perform some kind of noise reduction on an image or signal. The median filter is a nonlinear digital filtering technique, often used to remove noise. Such noise reduction is a typical pre-processing step to improve the results of later processing (for example, edge detection on an image). Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise. The main idea of the median filter is to run through the signal entry by entry, replacing each entry with the median of neighboring entries. The pattern of neighbors is called the "window", which slides, entry by entry, over the entire signal. For 1D signal, the most obvious window is just the first few preceding and following entries, whereas for 2D (or higher-dimensional) signals such as images, more complex window patterns are possible (such as "box" or "cross" patterns). Note that if the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically. For an even number of entries, there is more than one possible median. Typically, by far the majority of the computational effort and time is spent on calculating the median of each window. Because the filter must process every entry in the signal, for large signals such as images, the efficiency of this median calculation is a critical factor in determining how fast the algorithm can run. The "vanilla" implementation described above sorts every entry in the window to find the median; however, since only the middle value in a list of numbers is required, selection algorithms can be much more efficient. Furthermore, some types of signals (very often the case for images) use whole number representations: in these cases, histogram medians can be far more efficient because it is simple to update the histogram from window to window, and finding the median of a histogram is not particularly onerous.

Evaluation and results

To verify the effectiveness (qualities and robustness) of the proposed denoising technique, we conduct several experiments with this procedure on several MRI images.

In this work we load an MRI image and apply the different filtering technique on loaded image in the Image Processing Toolbox under the Matlab Software. Below steps of our proposed work is given:

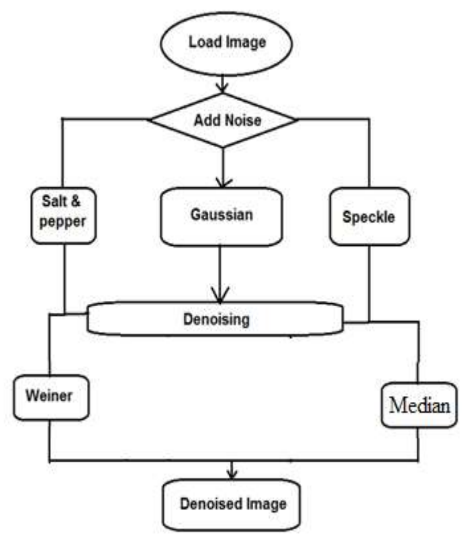
Phase 1: Firstly we develop a particular GUI for this implementation. After that we develop a code for the loading the MRI Medical image in the Matlab database.

Phase 2: Develop a code for the addition of noise in the image. We use Speckle, Gaussians, and Salt & Pepper noise in the proposed work.

Phase 3: Develop a code for the filtering methods. With the help of this we got the denoise image. Because by using the filter the chances of image corruption should be decrease.

Phase 4: After that we develop code for the calculation of the different parameters like PSNR, MSE etc. With the help of these parameters we can compare our proposed technique with previous proposed techniques.

Flow Chart of proposed method



In our proposed method, we denoise the MRI images .there are three type of noise: i) salt & pepper, ii) Gaussian and iii) speckle Noise. All result is given in below figures:

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Fig 1. Original Image

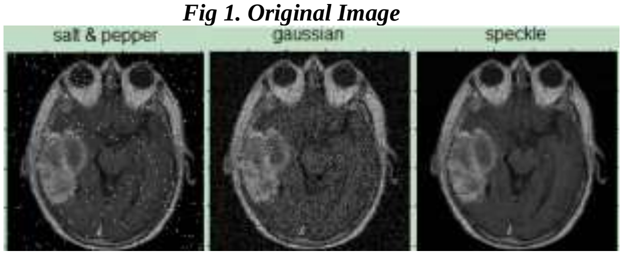


Fig 2. Noisy images

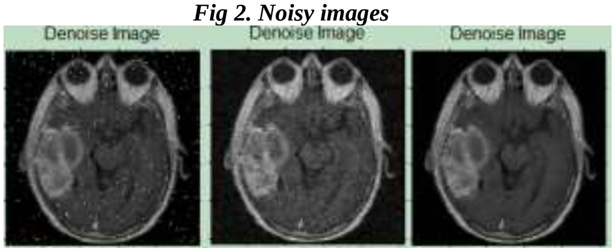


Fig 3. Denoise image using Weiner filter

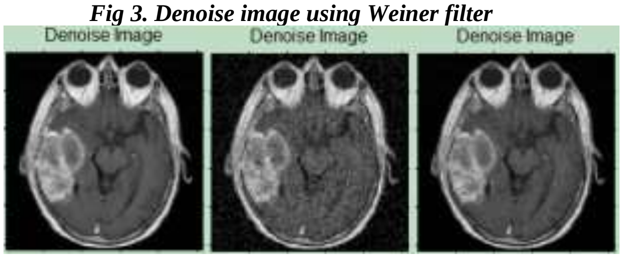
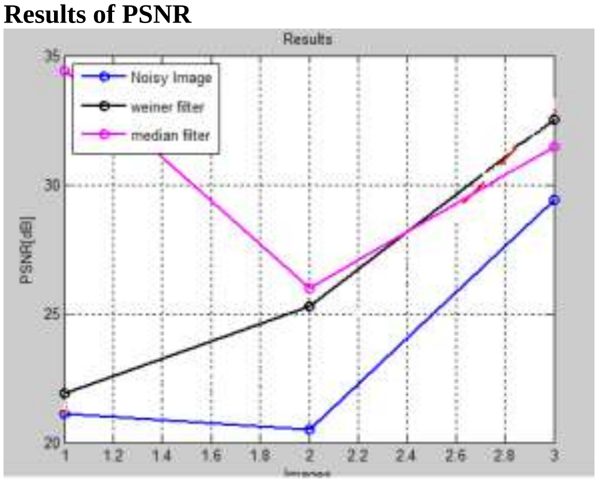


Fig 4. Denoise image using Median filter

Results of PSNR



Conclusion and future scope

The MRI image denoising method is proposed in the present work. In the present work we proposed an efficient analysis of MRI Image Denoising using different type of filtering methods. This technique is computationally faster and gives better results. Some aspects that were analyzed in this paper may be useful for other denoising schemes, objective criteria for evaluating noise suppression performance of different significance measures. Our new technique is better as compare to other techniques. In future we denoise images using Sure-let for get more denoise image and get more PSNR.

References

1. Afandi Ahmad, Janifal Alipal and Noor Huda Ja'afar in 2012. "Efficient Analysis of DWT Thresholding Algorithm for Medical Image De-noising". IEEE EMBS InternationalConference on Biomedical Engineering and Sciences .
2. M. Antonini, M. Barlaud, P. Mathieu, and I. Daubechies, Image coding using wavelet transform, IEEE Trans. Image Processing, vol. 1, pp.205-220, 1992.
3. P.L. Dragotti, G. Poggi, and A.R.P. Ragozini, Compression of multispectral images by three-dimensional SPIHT algorithm, IEEE Trans. on Geo science and remote sensing, vol. 38, No. 1, Jan 2000.
4. Thomas W. Fry, Hyper spectral image compression on recon_gurable platforms, Master Thesis, Electrical Engineering, University of Washington, 2001.
5. S-T. Hsiang and J.W. Woods, Embedded image coding using zero blocks of sub band/wavelet coefficients and context modeling, IEEE Int. Conf. on Circuits and Systems (ISCAS2000), vol. 3, pp.662-665, May 2000.
6. A. Islam and W.A. Pearlman, An embedded and efficient low-complexity hierarchical image coder, in Proc. SPIE Visual Comm. and Image Processing, vol. 3653, pp. 294-305, 1999.
7. B. Kim and W.A. Pearlman, An embedded wavelet video coder using three-dimensional set partitioning in hierarchical tree, IEEE Data Compression Conference, pp.251-260, March 1997
8. Lakhwinder Kaur, Savita Gupta, R.C. Chauhan ,"Image Denoising using Wavelet Thresholding" Deptt. of CSE SLIET, Longowal Punjab (148106),

ISSN: 2277-9655
Scientific Journal Impact Factor: 3.449
(ISRA), Impact Factor: 1.852

9. Iram Sami, Abhishek Thakur, Rajesh Kumar, “Image Denoising for Gaussian Noise Reduction in Bionics Using DWT Technique”,IJECT Vol. 4, Issue Spl - 3, April - June 2013 ISSN : 2230-7109 (Online) | ISSN : 2230-9543 (Print) 62 International Journal of Electronics & Communication Technology .
10. Sachin D Ruikar,Department of Electronics and Telecommunication , “Wavelet Based Image Denoising Technique”, (IJACSA) International Journal of Advanced Computer Science and Applications,Vol. 2, No.3, March 2011
11. G. Y. Chen, T. D. Bui And A. Krzyzak, Image Denoising Using Neighbouringwavelet Coefficients, Icassp ,Pp917-920
12. Sasikala, P. (2010). Robust R Peak and QRS detection in Electrocardiogram using Wavelet Transform. International Journal of Advanced Computer Science and Applications - IJACSA, 1(6), 48-53.
13. Kekre, H. B. (2011). Sectorization of Full Kekre ‟ s Wavelet Transform for Feature extraction of Color Images. International Journal of Advanced Computer Science and Applications - IJACSA, 2(2), 69-74.
14. Shashikant Agrawal, Rajkumar Sahu,“Wavelet Based MRI Image Denoising Using Thresholding Techniques”, International Journal of Science, Engineering and Technology Research (IJSETR) Volume 1, Issue 3, September 2012
15. M. Sonka,V. Hlavac, R. Boyle Image Processing , Analysis , And Machine Vision. Pp10-210 & 646-670
16. Raghuveer M. Rao., A.S. Bopardikar Wavelet Transforms: Introduction To Theory And Application Published By Addison-Wesley 2001 pp1-126
17. Arthur Jr Weeks , Fundamental of Electronic Image Processing PHI 2005.
18. Donoho.D.L,Johnstone.I.M, “Ideal spatial adaptation via wavelet shrinkage”, Biometrika,81,pp.425-455,1994.