NOISE REDUCTION USING CONTOURLET TRANSFORM

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Abstract- *Images are damaged by sound during detection, processing, signal processing and transmission through sound channels. The process of removing noise from images is termed as image denoising. In this paper we have implemented a new algorithm based on a variable named "contourlet transform". This algorithm works much better than the wavelet algorithm in image extraction and especially the removal of the shock wave. Parameters were considered by comparing wavelet and contourlet transformations by SNR and IEF. The results indicate that the proposed algorithm outperforms the wavelet in terms of SNR, IEF values and visual acuity.*

Keywords-: Contourlet transform, Despeckling, Pyramidal directional filter bank, Thresholding.

1. INTRODUCTION

The output of the image process in digital image processing is intended for audio removal, which may damage the image at the time of receipt or submission, during storage its quality. Photography remains a challenge for researchers because the removal of sound introduces the art of saying that it creates blurring of images[1].

Many algorithms are designed to solve, including the Lee filter, the Frost filter, the Gamma filter and their variants. Normal filtering is usually good at reducing visual acuity, but it also has fatal limitations on it preserving the sharp features of the original image and the high visibility of the ensemble. To overcome this evil, many methods have been developed to reduce noise using a discrete wavelet transform (DWT) as a multi-image resolution tool[2]. The wavelet change is positively converted to direction of unity, so it has a problem of showing selectivity. This is a major problem of wavelet-based performance. A contourlet change was recently made by Do and Vetterli [3] to overcome the limitations of wavelets. Based on two-dimensional functional multiscale and an intelligent filtering bank that can work effectively with smooth-mounted images.
The conversion of a new two-dimensional visual signal, known as the Contourlet Transform (CT) has recently been proposed as an alternative to advances in fragmentation and representation of natural images. This alters the scale to capture the geometrical structure within the visual information through multiple cohesion, multiple shapes [4].

Mao-Yu Huang et al. [5] presented a method for the minimization of the microscopic envelope of ultrasound images. The structure of the double filter bank and the minimum 4/3 decrease using the two placement methods show good promise for depreciation. Further, the contourlet transform based method yields better classification rate (75.2%) due to improved segmentation as compared to the Gaussian low pass filter based method (classification rate is 62.3%)[6].

2. Contourlet Transform

Contourlet change is a Vetterli image [7] of the neverical, directly supported, recently introduced by the Do and can best represent images containing contours and syntheses. Contourlet has many advantages compared to other convertible solvents for many solvents. Two different wavelets lack direction, and they are only good for the point reduction, but do not hold the geometry smooth. Contourlet has been developed as an upgrade for more pull-ups in line with this functionality. The resulting transform has the properties of high-frequency and frequency-time wavelets, but also provides a high degree of direction and anisotropy. Several local broadcasts and image frequency distributions are provided in wavelets. However, wavelets are not applicable to the display of smooth graphics[4].

As we find in the Fig. 1, wavelet transforms have square supports that suitably represent invalidity of points. The new scheme called contourlet transform, which represents multi-distance geometry analysis, contains remote and multi-directional supports near the contour. For wavelet comparisons change, multi-dimensional geometry analysis contains multiple sets of basic support functions, which can deliver a well-curved contour with few coefficients.

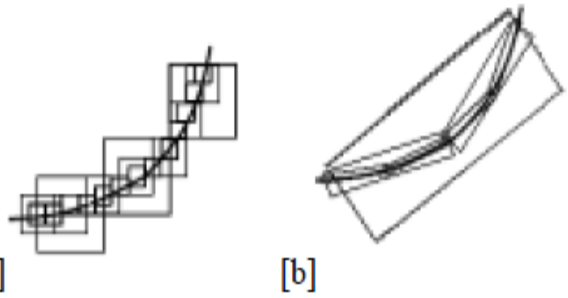

Fig. 1. Contourlet and wavelet representation of a contour. (a) Wavelets have square supports that capture the invalidity of points. (b) Contourlets have enlongated supports that capture linear segments of contours.

The contourlet transition can be divided into two main categories: Laplacian pyramid decomposition (LP) and directional filter banks (DFB).Contourlet transform is a high-resolution imagery and direction that uses the wavelet for the first time as an edge detection structure, then modifying the specific path of the section of the plain section. A double filter bank structure of the contourlet is shown in Fig. 2 for the expansion of expandable images for standard images with smooth computers.

In a double filter bank structure, the Laplacian Pyramid (LP) [8] is used to hold the position used and then followed by the Directional Filter Bank (DFB), which is used to attach points to vertical frames..

The band pass (dj [n]) images from the LP are transferred to the DFB so that the directional information can be captured. The scheme can heard on spam image (cj [n]). The combined effect is the formation of a double-dimensional bank structure built, named after the pyramidal directional image bank (PDFB), which cuts the images into pieces that are joined together on multiple scales.

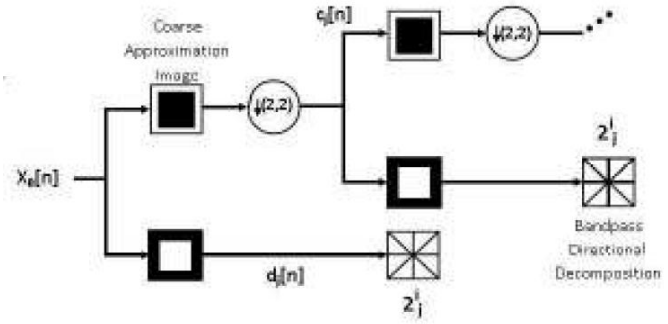

Fig. 2. The flow diagram of the contourlet transform.

3. EXISTING WORK

Chithra. K et al. [10] proposed A new Noise Reduction Technique to Suppress noise in Images, International Journal of Computational Intelligence Research ISSN 0973-1873 Volume 13, Number 3 (2017), pp.343-357, In this article we observe that how noise degrades the medical image during acquisition and transmission. It corrupts the fine edges and necessary information of original image. noise reduction is necessary to regain the fine edges and details of images. In this paper various techniques are discussed to suppress the noise and to enhance the image.The various techniques which are discussed are: - Hybrid Modified Filter: This filter is altered with the value of pixel(P) at the centre (3*3) with the maximum value of Modified Median pixel value of 8 neighbourhood P. Extra-Energy Reduction Filtering is used to supress the noise in images. Later logarithmic transformation is applied to Noisy Image and then Gaussian convolution Pre-process the image. Intelligent Water Drop Technique is used to suppress the noise by applying wavelet transformation of speckle noise and their soil velocity were calculated. The minimum value is replaced by mean value.

K. Karthikeyan et al. [11] proposed Noise Reduction of Medical Images using Bayesshrink Wavelet Threshold",International Journal of Computer Applications (0975 – 8887) Volume 22– No.9, May 2011, In this paper, wavelet-based Spot denoising is utilized where straight forward Discrete Wavelet Change is done trailed by thresholding step. Last advance accompanies the proposition of Direct Opposite Discrete Wavelet Change. Delicate thresholding administrator is utilized generally over the hard thresholding as alcoholic thresholding lessens the unexpected sharp changes. Bayshrink shrinkage system is utilized and it perform delicate thresholding with the information driven sub band subordinate limit. Antistrip dissemination (SRAD) channel is being utilized which is non direct smoothening channel. SRAD utilizes fourth request Halfway Differential Condition (PDE) way to deal with lessen spot clamour. Entire DE speckling model is fourth request PDE, Anisotropic dispersion with SARD channel joined with Bay shrink WSD. From the analysis result, PSNR estimation of unique to dot picture is seen as 22.95 and proficiency of proposed model is 70.96% which is most noteworthy among other conventional channels. Accordingly, this investigation proposes a cross breed model which comprise of Anisotropic Dissemination joined with SRAD channel and Bay shrink thresholding.

T.Ratha Jeyalakshmi et al. [12] proposed A Modified Method for Noise Removal in Medical Images", International Journal of Computer & Electrical

Engineering, Vol. 2, No.1, February, 2010 1793 - 8163 .This paper describes the algorithm used in reduction of noise which reduce the quality of images hence being very essential to eliminate. This algorithm is based on the Morphological Image Cleaning Algorithm (MIC) designed by Richard Alan Peters. In this method, the existing MIC algorithm was modified to get better result as compared to the original MIC algorithm. This algorithm finds the residual image i.e. the difference between original image & smoothed image. Removes features from the remaining image and returns it to the original image so that the features are saved. The output image quality and time complexity were enhanced showing more removal of noise. This algorithm is a disk-based detection system that is composed of materials with different radiation. In MIC, the image histogram is used for scanning where the MMIC instead of the standard deviation of the pixels in the image is used and the threshold is obtained. Using the Opening-Closing and Cling-Opening (OCCO) filter you will lose features less than or equal to the size of the object. Therefore, the image cleaned by this algorithm can be used as input to other image printing functions such as segmentation, segmentation, feature extraction etc.

S.Kalaivani Narayanan and et al. [13] proposed A View on Denoising in images, International Journal of Signal Processing, Image Processing & Pattern Recognition Vol. 2, No.3, September 2009 ,this paper includes the functioning of imaging system. The whole system consists of transducer which converts ultrasound radio frequency into electrical signals. Transmitter & receiver are placed at both the ends. There are several noise reduction methods discussed in this paper. Compounding methods is one of a type in which multiple images of same target is obtained from different angles & direction along with various transducers frequencies. On the other hand, post acquisition method doesn't need only hardware modification. Another method for denoising is single scale spatial filtering in which reduction filter is used that change the smoothing as per the ratio of local variance to local mean. Such filters are Kaon & Lee filters, frost filters, Diffusion filter etc. Diffusion filtering method proposed by Peroni & Malik in which partial differentiation equation is used in order to obtain smoothing image. Multi-scale methods are based on wavelet & pyramid. Wavelet based noise reduction method usually consist of logarithmic transformation, wavelet transformation, modification of noisy coefficient, invert wavelet transform. Thus, one has to take number of factors into account while making an efficient denoising model. The role of choice of denoising filtering plays a major aspect in designing of a denoising model.

Mateo, J.L. and et al. [14] proposed Finding out general tendencies in noise reduction in images, Vol. 36, Issue 4, pp. 7786-7797. This paper contains with the different technique for decrease of dot commotion. As dot clamour is multiplicative commotion which in term is hard to expel than added substance noise. First dot commotion is changed over into added substance clamour by log change. To diminish dot commotion different methods are utilized, for example, Median Filter, Weiner Filter and Gaussian Filter are applied. After this progression surface examination is performed utilizing the figuring of neighbourhood entropy of image, with limit selection, morphological operations, object windowing, determination of seed point and ROI age. Further, other algorithm is utilized to remake the image which was lost during dot commotion decrease. The Mathematical Morphological activity are utilized in the Algorithm. Different strategies which are utilized to denoise the commotion are Multiple look preparing (It takes the normal of spot clamour in a few "looks "at a point in single radar clear), Adaptive and Non Adaptive channel (Adaptive channel adjusts the length to the picture to the dot level and Non Adaptive Filter utilizes the versatile channel weight and apply consistently to picture), Texture Analysis (Used when the picture is more portrayed by its surface than force) and Wavelet based dot decrease technique (It utilizes Logarithmic transformation, Wavelet change, Modification of commotion and invert wavelet change).

S. Sudha et al. [15] proposed S Noise Reduction in images using context-based adaptive Wavelet Thresholding, International Journal of Computer Theory & Engineering, Vol. 1, No. 1, April 2009 1793-8201. Numerous endeavours have been made to diminish the spot commotion utilizing wavelet change. At the point when multiplicative spot commotion happens, the multiscale strategies draws in a pre-processing step which comprise of logarithmic change of picture. In discrete wavelet clamour sifting, a non-excess and remarkably spoke to flag is watched. The strategy for wavelet deterioration comprises of continuous activities on lines and sections of a 2-D data. During a scalar vector decay of picture, the 2-D information is supplanted with four blocks. This process makes a network where left side contains low pass coefficients and right side comprise of high pass coefficient. Four kinds of coefficient I.e. HH, HL, LH, LL. Choice of edge esteem is significant, an ideal worth called general limit is picked which relies upon the size of image(N), noise standard deviation. Weighted fluctuation is characterized for coefficients y[m,n] which decides the threshold. Parameter weighted difference comprise of neighbouring coefficients of wavelet disintegration . lcount of nearby variance. The assessed estimation of neighbourhood weighted change is done from the sub band HH1 by utilizing middle.

4. THE CONTOURLET PROPOSED BASED DESPECKLING ALGORITHM

The sound often manifests itself as a beautiful vertical structure in the image, leading to the cutting edge of the edges. Contourlet change uses contour smoothness effectively by looking at the various directions that follow contours. The modification involves a pyramidal directional bank of images [4], where the Laplacian pyramid [8] is first used to find the stop point, and then the directional image bank [9] to link the point of nonlinear structure. In addition, the edge is designed to reduce transparency. The contourlet transform can be designed to be a tight frame along with thresholding in order to achieve denoising of the image more effectively. The steps involved in the proposed method are given in the algorithm 1.

Algorithm 1: Despeckling of an input image.

Steps for Proposed methodology for Image representation-:

1.Take the input image.
2.Do Multiscale and directional decomposition of input Image(Which is DFB).
   a. Do Multiscale Analysis of Input Image.
   b. Do Multidirection Analysis of Input Image.
3.Apply the contourlet expansion on Multiscale and multidirection analyzed Image.
   a. Do the Parabolic scaling.
   b. Do the Directional vanishing based on cumulative density by calculating the weight vector of image.
   c. Do the Contourlet approximation.
4.Take Contourlet efficient Image.

5. EXPERIMENTAL RESULTS AND DISCUSSION

The result of this paper aims to implement contourlet transform on noisy image, image compression and denoising. In this paper a true multidirectional transform is used that can capture the intrinsic geometry of structure. The paper stresses on the use of multiresolution, multidirectional contourlet transform and the threshold denoising.

Fig 3. Original Image

Fig 4. Add Noise image

Fig 5. NLA Using Wavelet (M=6554,SNR=12.06 dB)

Fig 6. NLA Using Contorlets (M=6554 COEFS,SNR=13.18

Experimental results show that the effect of image denoising is much better than the wavelet transform and individual thresholding is way better than that in wavelet transform.

6. CONCLUSION

The existence of noise in the image is undesirable since it degrades image quality by affecting edges and local details. Wavelets transform and contourlets transform produces sharp boundary of image. So they are used for the remove speckle noise in ultrasound image. It is used for the compression to make the boundaries sharp so everyone can detect the edges.

In our approach contourlet trasnsform has been implanted to detect and rectify the degraded image. PDFB and Directional filters(DFB) are being used as a primay filters used for contourlet transform. multi-scale methods are tested and compared for images. These methods have been proven to be very effective in controlling the frequency and gaussian noise. The Laplacian pyramid

transform and contourlet transform based despeckling methods are applied recently on images and proves to give very good results. In the later several results based on the wavelet transform has been taken. Wavelets is powerful tool for image denoising. The discrete wavelet converts the image maps into a set of coefficients that make up the bulk image representation. A comparision between the results of wavelet(DFT) and the contourlet has been done.The SNR and PSNR values were compared showing contourlet transform is best for image denoising.

7. FUTURE SCOPE

This research has focused on providing better and effective noise reduction techniques for different type of images. The problem like degradation of image quality during its processing due to random noise addition in the image is mentioned. In order to solve this issue, the Contour let transform technique is applied. Contour let transform is almost critically sampled, with a small redundancy factor of 1.34. Comparing this with a much larger redundancy ratio of the discrete implementation of the curve let transform, the contour let transform is more suitable for image compression. Experiments with real images indicate the potential of contour lets in several image processing applications. Wavelet Based Contour let Transform can also be extended to bio-medical videos like endoscopes and orthoscopes as a video watermarking system. Image restoration, image enhancement and image despeckling can be performed by using contour let transform with suitable algorithms.

The further denoising of the proposed method can be focussed on the following ideas for better results and more effective image restoration**:**

- Removing noise from an image depends on different statistical properties of noise and signal. In future, care must be taken to deal with the statistical properties of noise and signal.
- Better learning techniques can be used to increase the performance of the method & quality of the output.
- In a future work the combination of the coefficients from both transforms into zero trees (representing the inter-scale dependencies) will be studied.

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