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Denoising of Medical Images Using a Reconstruction: Average Mechanism

J. Chitra
Department of Information Technology, Karunya University, Coimbatore, India
D. Narmadha
Department of Information Technology, Karunya University, Coimbatore, India

Abstract:
A beginning to deal with denoising the signals specifically the images is proposed by reconstructing the conventional mechanism. Various constituents of the overall scope are chosen, from each of which a signal can be rebuilt using a Singularity Function Analysis (SFA) model. The concept thus accomplishes denoising by reconstructing the images using the reality that each is the sum of the same image which is free from noise with an additive noise removing process. The observed consequences on both simulated and monochrome images show that the suggested method permits effective denoising while asserting the quality of signal.

Key words: *Denoising, Singularity Function Analysis (SFA), Noisy image*

1. Introduction

A signal is corrupted by some additional noises while it is transmitted. The aim of the specific denoising method is to eliminate the noise when the image is hold as much as potential of the specific signal characteristics. Many researchers have developed various algorithms for selecting parameters for denoising and till now, never achieved such determination processes.
The denoising can be achieved by functional flow of linearity in processing such as wavelet transform (WT), etc., because of its excellent localization property, it rapidly become an essential image processing tool for variety of applications, including compression and denoising. Wavelet denoising attempts to remove the noise present in the signal while preserving the signal characteristics, no matter of its frequency content.

2. Methodologies

Images with noise levels necessitate mainly three steps: a forward wavelet transform, a linear inverse wavelet transform and a nonlinear wavelet thresholding. In this field of algorithm, the noticed signal has a higher signal-to-noise ratio (SNR) at lower frequencies and a lower SNR at greater frequencies because, the spectral energy density of the noise is uniformly disseminated in the whole signal and energy density of the conventional noise-free images decreases quickly with its frequency increasing. Many algorithms can summon other denoising algorithms such as wavelet methods.

3. Analysis of Different Algorithms and Techniques

3.1. An Algorithm for Total Variation Minimization and Applications

An algorithm for reducing the complete variation of the signals tells about rendering an identity of convergence show applications to zooming, the computation of the mean curvature motion of interfaces and signal denoising. The wavelet transform has been implemented to inhibit noise in images. The reduction in wavelet coefficient values is successful in image restoration.

3.1.1. Advantages

- The image denoising using this minimization technique suggests the concept of smoothing. So, this concept can pave the way for more efficiency.
- Redundancy of smoothing noise can be avoided using the minimization techniques and the application of total variation is used for noise removal.

3.1.2. Disadvantages

- As we are doing with minimization of the total variation of images, the size of image may vary, so it affects the quality of the signal.
- The technique of using Mean Curvature is not possible for all the images as it supports redundancy.

3.2. Improved Image Denoising Technique Using Neighboring Wavelet Coefficients of Optimal Wavelet with Adaptive Thresholding

Thresholding is an estimation procedure that feats the capacities of wavelet transform for image denoising uses. But the optimum selection of the thresholding function and the wavelet are limited with drastic spread out usage in denoising application. The algorithm suggests some new thresholding method for signal denoising in the wavelet.

More efficient thresholding techniques can also be introduced by implementing the neighboring wavelet coefficients, with variety of threshold for various sub bands and it depends on the Gaussian distribution.

3.2.1. Advantages

- DWT technique gives us the maximum level of accuracy in separation of the sub bands in image transformation technique.
- Due to the use of DWT, Wavelet thresholding is quite efficient to implement.

3.2.2. Disadvantages

- A normal DWT can never retrieve the exact output value image. So, some wavelet types are needed to be improved and implemented.
- The optimal selection of the wavelet transformation is needed to be improved.

3.3. A Review of Wavelet Denoising In MRI and Ultrasound Brain Imaging

In contrast to many imaging applications, the performance of the denoised image is validated by how it detects the medical data; medical applications inflict other responsibilities, where for example smoothing of "features of interest" is intolerable as well as the generation of artifacts that could be misinterpreted as clinically interesting features. The speedy improvement of image processing or imaging technology such as medical images with some noise levels, makes some requirement for a novel image processing technique including specialized noise filtering, enhancement of the image, classification and segmentation procedures.

3.3.1. Advantages

- Speckle Filters are used to reduce/remove noise. So, noises can be reduced as efficient as possible.
- It works with the concept of ROI (Region of Interest). So, it's more efficient in specifically identifying the location.

3.3.2. Disadvantages

- When compared, the concept of denoising using this technique is little difficult.
- The preprocessing step which is used here is a reproducible one. So, image denoising concept can't be brought out into concern.

3.4. Color Image Denoising Using Wavelets and Minimum Cut Analysis

Wavelet thresholding has derived to be an edge-upholding method for denoising grayscale images, specifically when it exploits the inter-scale co relevance of wavelet cofactors. Intra-scale co relevance can be improving the denoising operation, but the benefit for color separated images is said to be small.

The manifestation that gets some values, become significant in RGB image denoising, specifically for smooth image color-difference components. The validation performance of denoising approach looks on the efficiency of wavelet classification. Simple thresholding of separate wavelet coefficients targets satisfactory results but can be importantly developed by working on the inter-scale correlations.

3.4.1. Advantages

- The inter-scale and the intra-scale co-relations pave the way in segmenting the denoising part separately.
- The min-cut, graph exploiting, intra-scale components are used efficiently to get the denoised image exactly.

3.4.2. Disadvantages

- Thresholding is the most ancient technique which can't derive a maximum level of accuracy.
- Min-cut is only for a specific purposes and it can't be used for all the factors.

3.5. Image Denoising Via Sparse and Redundant Representations over Learned Dictionaries

With the growing actualization that regular separable 1-D wavelets are inappropriate for handling images, several new tailored multi-scale and directional redundant transforms were introduced, including the curvelet, contourlet, wedgelet and the steerable wavelet. Using repetitive representations and sparsely for denoising of images has depicted a lot of exploration. The conclusion to turn to surplus representations was the hope to shifting characteristics invariance.

3.5.1. Advantages

- Generally, there are two such as local and global features. The technique is mainly imparted for giving the global feature values where entire image noise can be diagnosed.
- Sparsity and the redundancy keep the denoising value more accurately.

3.5.2. Disadvantages

- Singular Value Decomposition (SVD) decomposes the value up to a certain limit only. This will provide us the value of approximation but not in detailed coefficients.
- The training on the corrupted image is still in some challenging criteria.

	An Algorithm for Total Variation Minimization and Applications	**Improved Image Denoising Technique Using Neighboring Wavelet Coefficients of Optimal Wavelet with Adaptive Thresholding**	**A Review of Wavelet Denoising In MRI and Ultrasound Brain Imaging**	**Color Image Denoising Using Wavelets and Minimum Cut Analysis**	**Image Denoising Via Sparse and Redundant Representations over Learned Dictionaries**
Goal	Denoising	Denoising	Denoising	Denoising	Denoising
Approach	Signal denoising by using convergence	Image denoising using Gaussian distribution	Image denoising with respect to Region of Interest	Signal denoising with Min-Cut analysis	Image denoising with various wavelet analysis
Methodology	Locating Convergence	Denoising by thresholding	Region of Interest	Inter-sale & Intra-scale analysis	Wavelet, curvelet, symlet classification
Algorithm	Convergence & total variation	Gaussian	Ultrasound imaging technique	Min-Cut, Intra-scale analysis	Wavelet transformation
Input	Noisy signal	Noisy image	Image with speckle noise	Noisy signal	Noisy image
Output	Denoised signal	Denoised image	Denoised image	Denoised signal	Denoised image
Factors affects detection and extraction	Total variation is not effective in deriving extraction process	Gaussian noise can only be removed using this algorithm	Speckle noise reduction is the oldest one and this can be imparted for all the images or signals	The minimum level cutting analysis disturbs the image with some eroding factor	Wavelet transform is applicable for using the denoised image from either of the techniques.

Table 1

4. Conclusion

Each and every idea will have its own advantages and demerits. Here it is shown about some relevant techniques and we have understood about its pros and cons. With reference to these papers, we are in need of giving a novel implementation.

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