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Gabor Feature Based Nonlocal Means Filter for Textured Image Denoising

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***Abstract*:**
Image denoising is still a challenging one as day to day more and more techniques and implementation comes. Moreover, whatever the technique we use, it has its own set of merits and demerits. The nonlocal means (NLM) filter has its own rewards that beat the conventional signal denoising algorithms. Non Local Means filter recovers noise-corrupted images by relocating the pixel value with the weighted pixel, where each weight is termed depending upon the Gabor-based texture measure. The purpose of the Gabor feature based Non-Local Means filter for textured signal denoising. The conventional Non Local Means filter and four other signal denoising techniques in textured images are dissipated by Additive Gaussian Noise (AGN). Our outcomes show that the proposed filter can denoise textured signals more effectively.

Key words: *Additive Gaussian Noise, Gabor Feature Extraction, Non local Means Filter (NLM)*

1. Introduction

Various characteristics related to the local spectrum of signals have been proposed and applied in one way or segmentation, and/or classification. Denoising is one of the most fundamental tasks in image analysis. It targets to improve the quality of an observed image by removing the noise contained in it, so that processing, such as classification, image segmentation and interpretation can be performed with higher accuracy.

The relation to the local scope is demonstrated characteristics that are received by filtering the input signal with a set of 2-D Gabor filters. It's a development of a Gaussian and a cosine function. The filter is termed by a preferred spatial frequency. A two dimensional Gabor filter acts as a local band-pass filter with certain optimum joint localization characteristics in the signal.

2. Methodologies

Signal denoising has been widely researched out and a large number of denoising algorithms have been proposed. Somehow, due to the quandary of suppressing the noise level in the signal and preserving the signal details, it still persists as a major challenge to denoise images, especially textured signals. A probability example for both the noise and for uncorrupted images is having more advantageous importance for this application.

Extraction of representation of any signals is a hectic one that has been investigated already by many researchers. In all those techniques, there is an elementary assumption that the imparting of the technique can be fixed. A novel algorithm is addressed as the issue of designing the proper technique in order to make the algorithm fit best with the model implemented.

3. Analysis of Different Algorithms and Techniques

3.1. Nonlinear Total Variation Based Noise Removal Algorithms

An encumbered optimization algorithm for removing noise from images is presented. The total variation is minimized subject to change based on the constraints involving the statistics of the signal's noise. The outcome is obtained using the gradient method. This is tentative to solve a time dependent equation determined by the constraints. The numerical algorithm is simple and comparatively fast. The results appear to be often closer for every noisy signal. The method is non-invasive, conceding edges in the image.

The algorithm could be translated as a first step of moving each level set of the image normal to itself with velocity equal to the curvature of the level set divided by the magnitude of the gradient of the image

3.1.1. Advantages

- Non-linear algorithm gives us the clear idea of denoising the edges. So, it paves way for edge preservation.
- Can be implemented for blurry and frozen images.

3.1.2. Disadvantages

- More mathematical derivatives, so method is more complex.

3.2. Image Denoising using Scale Mixtures of Gaussians in the Wavelet Domain

Neighborhoods of coefficients at nearer positions and scales are postured as the product of two independent random variables: a hidden multiplier and a Gaussian vector. These are used in modulating the local variation of the coefficients in the neighborhood and thus able to explain the empirically observed correlation.

By using this technique, the square values estimate each coefficient then it gradually decreases a weighted average of the linear estimate over all possible values of the hidden variable. The algorithm demonstrates the simulations with images contaminated by Additive White Gaussian Noise that the functioning of this algorithm considerably exceeds that of conventional ideas, both visually and in terms of mean squared error and such other performance validations.

3.2.1. Advantages

- More robust for statistical images with Gaussian noises.
- Gaussian scale mixtures play a vital role in noising/denoising.

3.2.2. Disadvantages

- Usage of GSM Multiplier has been imparted over here, which is having vacillation character.
- Mathematical complexity in deriving the components and noise removal.

3.3. The Curvelet Transform for Image Denoising

An instrument/concept that gives concept of denoising through mathematical derivation is Fourier-domain calculation of a digital Radon transform. Preliminaries that include various concepts like orthogonal wavelet thresholding coefficients of the noisy image and then later the reconstruction process. Efforts have been taken that the substantial improvements that have perceptual quality could be obtained by many invariant methods depend upon thresholding of wavelet transforms. Our work offers the demanded reconstruction, stability against disruptions, implementation simplicity and low calculating complexity.

3.3.1. Advantages

- New algorithms of wavelet transforms are robust and it is efficient..
- Digital data are sampled easily as per the given polar sampling techniques.

3.3.2. Disadvantages

- Ridgelet transforms are used only for discrete signals. So, Wavelet transforms can't support all the time.
- In comparison, it is found that denoising of color image is having some limitations.

3.4. Nonlocal image and movie denoising

Conventional filters are nothing but using the non-local image and movie filters which decreases the noise by sampling the similar pixels. The ultimate aim is to present a concept of these filters and to compare them to other filters. A noise model presents warranting the use of neighborhood filters. A categorization of the nearest filters will be proposed, including conventional image and motion picture images denoising methods and discussing a recently introduced nearest filter, Non Local Means filter.

Subject to compare denoising methods three concepts will be discussed. The first concept, "method noise", specifies that only noise must be removed from a signal. Second concept, "noise to noise" - according to this, a denoising technique must transform a white noise into a white noise. At last "method noise", this concept, which describes user-error-free techniques, that removes any subjectivity and this can be assured with Fourier analysis.

3.4.1. Advantages

- Neighborhood filters are nothing but the introduction of the NLM Filters that are more robust in denoising.
- The technique derives the concept of denoising based on "patch removal", so meager level of noise could be eliminated

3.4.2. Disadvantages

- Problem in deriving the local nearest filters with NLM, because the pixel adjustment gets disturbed.
- There occurs problem in averaging, because it affects the Region-selected data from the signals also.

	Nonlinear total variation based noise removal algorithms	Image Denoising using Scale Mixtures of Gaussians in the Wavelet Domain	The Curvelet Transform for Image Denoising	Nonlocal image and movie denoising
Goal	Denoising	Denoising	Denoising	Denoising
Approach	Denoising of signals through a novel technique	Pixel neighborhood classification for denoising	Using a subset of Wavelet transform, denoising	Denoising in Moving pictures
Methodology	Non local total variation denoising	Gaussian scale mixtures	Digital Radon Transform	NLM local filters
Algorithm	Total Variation	Gaussian noise removing technique	Curvelet Transformation	NLM neighborhood filters
Input	Noisy image	Noisy image	Noisy image	Noisy image
Output	Denoised image	Denoised image	Denoised image	Denoised image
Factors affects detection and extraction	Mathematical derivates affects denoising	Usage of GSM multiplier makes the system complex	Color image denoising is poor when compared	Problem in averaging as the nearest pixels get affected.

Table 1: Analysis of denoising techniques

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.

5. References

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