GIS Based Satellite Image Denoising Using Curvelet Transform

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Abstract

Generally, satellite images contain very significant information about geographical features such as rivers, roads, building and bridges etc of the earth. Geographic Information System (GIS) requires these features for automatic detection and it has been corrupted by various types of noise. Curvelet Transform (CT) is used in the proposed system for denoising the images. Advantages of multi resolution image such as line, compatibility of human visual system and edge detection are provided. Then K-Means clustering is used in this system for segmentation purpose after the pre processing done.

First, K-Means algorithm is used for segmenting background and water then extraction of bridges is done based on pixel intensity difference.

1. Introduction

Shearlet transform based satellite image denoising is presented in [1]. Shearlet transform is used for denoising the satellite images and Artificial Bee Colony (ABC) optimization is used for selecting the threshold value for denoising. Linear Discriminant Analysis (LDA) based on clustering for SAR Image denoising is described in [2]. Noise clustering is the main task for denoising SAR images into various disjoint local regions and again it denoised every splitted regions using wiener filtering in domain LDA. Dual Tree Complex Wavelet Transform (DT-CWT) based satellite image enhancement for denoising and illumination enhancement is discussed in [3]. Noisy input images are decomposed into various frequency sub bands using DT-CWT and these sub bands are denoised using local adaptive bivariate shrinkage function. DT-CWT is used to decompose the denoised image again into different frequency sub bands. Finally, inverse DT-CWT reconstructs the image.

Satellite image clustering in HSV and RGB Color Space based on k-means is explained in [4]. Here RGB color space performance is decreased by using k-means when compared to HSV color space. More number of color spaces is compared in this method. Evolutionary algorithms based enhanced sub-band adaptive thresholding function for satellite image denoising is described in [5]. ABC, Cuckoo Search (CS) and particle swarm optimization is the stochastic global optimization techniques for parameters learning of adaptive thresholding function. ABC and CS approach are used for denoising. Weiner filter with SPEA2 algorithm based satellite image denoising is presented in [6]. Land use and land cover classification of LISS-III satellite image using KNN and decision tree is presented in [7]. High noise level and pre filtering are removed by using Weiner filter with SPEA2 algorithm and it denoised the images then improved algorithm is extended. Finally PSNR and SNR are calculated. Genetic algorithm based image super resolution using wavelet transform is implemented in [8].

2. Methodology
2.1. Curvelet Transform

CT is used in the proposed work for denoising the satellite images for detection of bridges. It is a multi scale multidirectional transform which can consistently rebuild line shaped edge features. More complex curvelet is the first generation curvelet due to the need of Ridgelet transform. Spatially selected Fourier samples and wrapping based computation is the second

generation. Curvelet characteristics are a good one used to denoising the satellite images is proposed.

2.2. Bridge Detection

There are different steps are involved in this bridge detection algorithm for segmentation. First step of detection is the segmentation using k-means used to differentiate the background and foreground region. Then histogram techniques also used to get more accurate results based on k-means. Block diagram of the proposed satellite image denoising is shown in figure below.
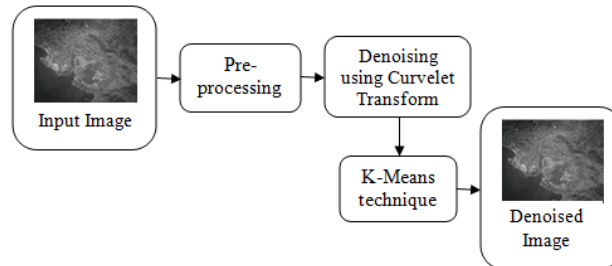

Figure 1. Block diagram of the proposed satellite image denoising technique

3. Experimental Results

SAR image is given as input shown in the figure. It is generally suffer from the noise. CT is proposed in this paper to denoise the image. This section tells about proposed denoising scheme using CT is exploited for satellite images. Performance of the proposed scheme is computed by PSNR value. Figure 2 shows the proposed (a) noisy image and (b) denoised image.
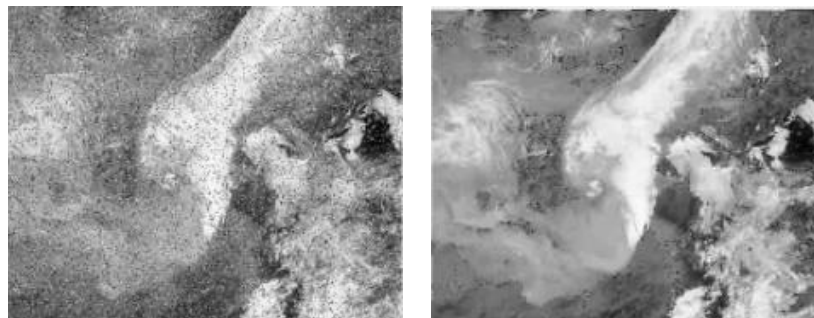

(a)   (b)
Figure 2. (a) Noisy image (b) Denoised image

4. Conclusion

A novel approach to denoise the satellite images was developed using thresholding based on CT is proposed. From the investigational results the image denoised using the proposed method was found to be more visually tempting than other existing algorithms. Figure 2 shows the proposed bridge detection and denoised image using k-means technique. The results show that k-means method is a very efficient optimization and obtained PSNR value is 32.52.

References

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