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A Proficient Roi Segmentation with Denoising and Resolution Enhancement

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Abstract:
Region-of-interest (ROI) detection technology, which has been introduced into the remote sensing image analysis field for segmentation. In existing method, Frequency domain analysis and salient region detection (FDA-SRD) method are used, which has drawbacks: inaccurate, missing detection and low image resolution. Efficient, denoisy, enhanced and accurate ROI images based on Switching Bilateral Filter(SBF) and wavelet (DWT and SWT)transforms are proposed. First, Denoising the remote sensing image using switching bilateral filter. Second, Extract the desired output by using frequency domain analysis and salient region detection. Finally, Image resolution and contrast are enhanced by discrete wavelet transform and stationary wavelet transform. Compared with existing models, the proposed method is more efficient and provides more visually accurate detection results.
General Terms: Color segmentation, Median filter, ROI segmentation, SBF, Wavelet transforms.

Keywords: *FDA-SRD model, Switching scheme, DWT and SWT transforms*

1. Introduction

Images are considered as one of the most important medium of conveying information. One of the first steps in understanding images is to segment them and find out different objects in them. The process of image segmentation is defined as: “the search for homogenous regions in an image”. Image segmentation [vi] is the process of dividing the given image into regions homogenous with respect to certain features. Segmentation plays an important role in image understanding, image analysis and image processing. Color segmentation [iv] of image is a crucial operation in image analysis, image interpretation, and pattern recognition system, with applications in scientific and industrial field(s) such as medicine, Remote Sensing, content-based image and video retrieval [v]. The most common features used in image segmentation include texture, shape, grey level intensity, and color. The clustering [i] approaches were one of the first techniques used for the segmentation of images. The segmentation of color based method can only consider a particular range of color so it may lead to missing detection. Thus, proposed ROI segmentation algorithm. Region-of-interest detection technology, that draws attention is defined as a focus of attention. This technology has been introduced into the remote sensing image analysis field and comprise high amounts of data. The computing resources can be reasonably allocated to enhance the image processing system. A faster, detection algorithm based on subsampling visual attention model The biological models can simulate the HVS well,and not consider the characteristics in frequency domain..Thus, FDA-SRD method used for processing of remote sensing images. In the FDA-SRD model, the input image is subsampled by a factor of 2 and is preprocessed using the HSI transform. HSI color space is consistent with the human color perception system and is better than the RGB color space, remote sensing images are often transformed from RGB space to HSI space. After the HSI transform, the frequency domain analysis based on quaternion fourier transform is been used to generate a saliency map. Then, an adaptive threshold segmentation algorithm based on Gaussian Pyramids is employed to obtain ROIs. A Gaussian pyramid is a technique used in final saliency map generating. Gaussian pyramid decomposition will generate a series of images in which each image is a low-pass-filtered copy of its predecessor. The low-pass filtering is performed via convolution using a Gaussian filter kernel and down-sampling operator Sometimes, this detection technology detects images with poor image contrast and resolution which may cause false detection. To enhance this, SBF and wavelet (DWT and SWT) transforms are used.

Switching Bilateral Filters are used to remove all kinds of universal noises such as salt-and-pepper ,gaussian noise and impulse noise. In switching scheme, the noise detector searches for noisy pixels in a corrupted image and tries to differentiate them from incorrected ones. The filter applied to the noisy samples only, thus, preventing blurred edges. It has to be capable of keeping the details and edges in an image when noise is detected. It provides a sharper image than a other filters. Thus, denoised image are obtained from the SBF which is given as an input image for ROI extraction.

To enhance the ROI extracted image by using wavelet (DWT and SWT) transforms. The DWT has been employed in order to preserve the high frequency components of the desired image. The output of each level of SWT contains the same number of samples as the input. The high frequency subbands obtained by SWT of the input image are added into the interpolated high frequency subbands. In parallel, the low frequency subband of SWT and DWT goes through the singular value equalization process, which preserves high frequency components. Hence after IDWT, the desired output image will be sharper with good resolution and contrast.

2. Literature Review

Existing methods on using a color segmentation algorithm for image segmentation/extraction of features. Mainly the images are filtered by median filter.

2.1. Color Segmentation

Color segmentation of image is a crucial operation in image analysis and in many computer vision, image interpretation, and pattern recognition system, with applications in scientific and industrial field such as medicine, Remote Sensing, content-based image and video retrieval. The most common features used in image segmentation include texture, shape, grey level intensity, and color. For image segment based classification, the images that need to be classified are segmented into many homogeneous areas with similar frequency information firstly, and the image segments' features are extracted based on the requirements of features classification. A novel image segmentation based on color features with K-means clustering algorithm [ii]. The entire algorithm is divided into two stages. First enhancement of color separation[3] of satellite image using decorrelation stretching is carried out and then the regions are grouped into a set of classes using clustering algorithm. The red-color segmentation of road image (see Figure 1).

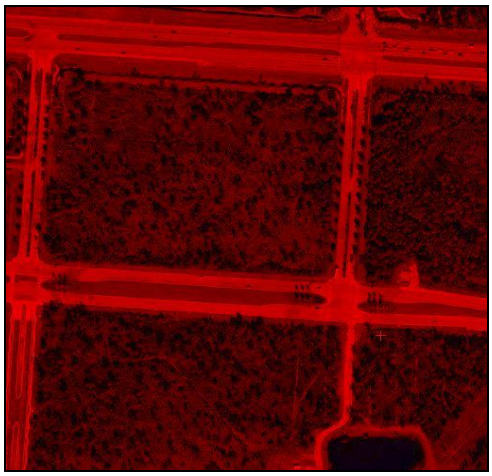

Figure 1: Red color segmented road image 1

2.2. Median Filter

Median filter is normally used to reduce noise in images. It is a non-linear digital filtering. It is one kind of smoothing technique. All smoothing technique are effective at removing noise in smooth region of signal, but adversely effect edges. Its performance is not that much better than Gaussian, whereas, for salt and pepper noise, it is particularly effective. So it is widely used in image processing (see Figure 2).

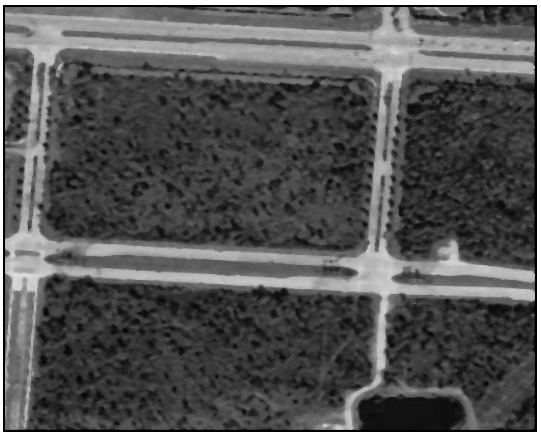

Figure 2: Output of Median filter

3. Problem Formulation

The segmentation of color based method can only consider a particular range of color so it may lead to missing detection. Thus, proposed ROI segmentation algorithm. Region-of-interest detection technology, that has been introduced into the remote sensing image analysis field. Thus, FDA-SRD method used for ROI extraction. Switching Bilateral Filters are used to remove all kinds of universal noises presented in the image. It provides a sharper image than a other filters. Thus, denoised image are obtained from the SBF which is given as an input image for ROI extraction.To enhance the ROI extracted image by using wavelet (DWT and SWT) transforms. Hence after IDWT, the desired output image will be sharper with good resolution and contrast.

4. ROI Segmentation with Denoising and Enhancement

ROI segmentation is done by using FDA-SRD model. The remote sensed image is first filtered by using switching bilateral filter(SBF).Finally, the extracted image is enhanced by DWT and SWT wavelet transform(see Figure 4).

4.1. FDA-SRD Model

Region-of-interest detection technology with FDA-SRD model(see Figure 3), we proposed for better segmentation algorithm instead of color-based segmentation algorithm.ROI comprise high amounts of data and introduced for remote sensing images. A faster, detection algorithm based on an adaptive spatial subsampling visual attention model The biological models can simulate the HVS well, but they often lead to prohibitive computational complexity and not consider the characteristics in frequency domain. Thus, FDA-SRD method used for processing of remote sensing images. In the FDA-SRD model, the input image is subsampled by a factor of 2 and is preprocessed using the HSI transform.

HSI color space is consistent with the human color perception system and is better than the RGB color space, remote sensing images are often transformed from RGB space to HSI space. After the HSI transform, the frequency domain analysis based on quaternion fourier transform is been used to generate a saliency map[vii]. Then, threshold segmentation algorithm based on Gaussian Pyramids is employed to obtain ROIs. A Gaussian pyramid is a technique used in final saliency map generating [viii]. Gaussian pyramid decomposition will generate a series of images in which each image is a low-pass-filtered copy of its predecessor. Sometimes, this detection technology detects images with poor image contrast and resolution which may cause false detection.

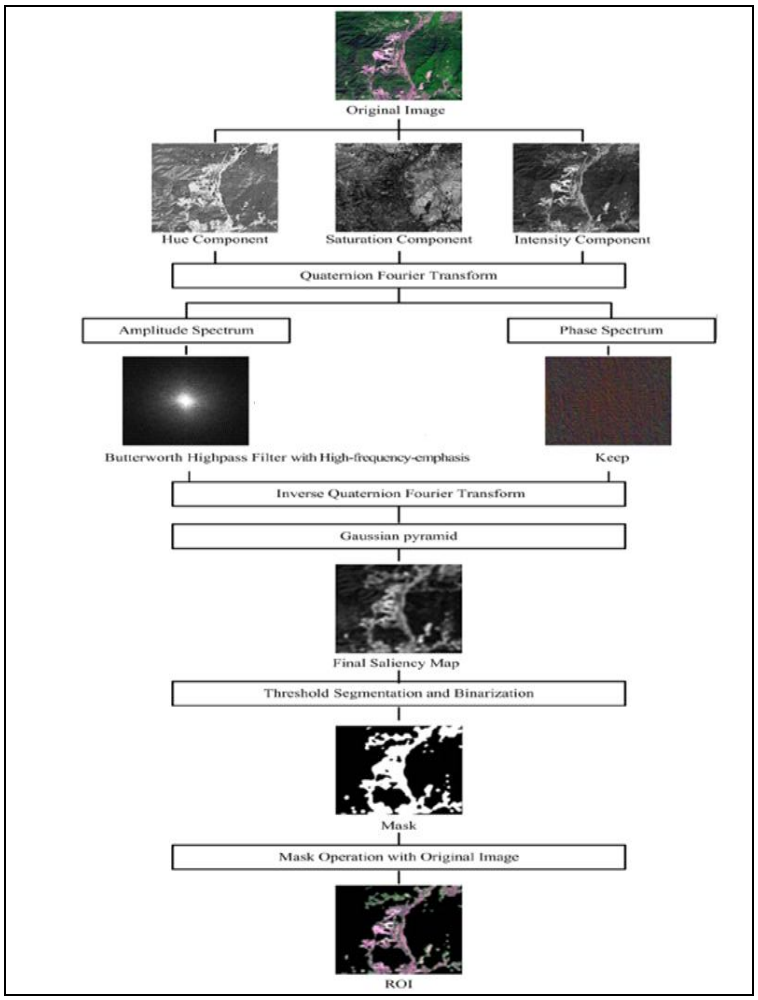

Figure 3: FDA-SRD model

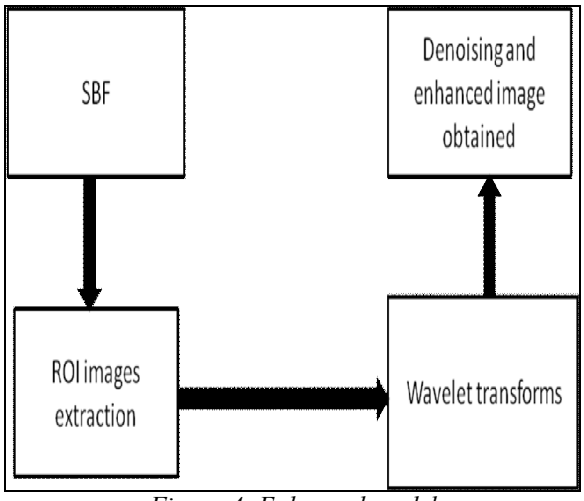

Figure 4: Enhanced model

Figure 5: Noisy road image 1

Figure 6: Filtered by SBF

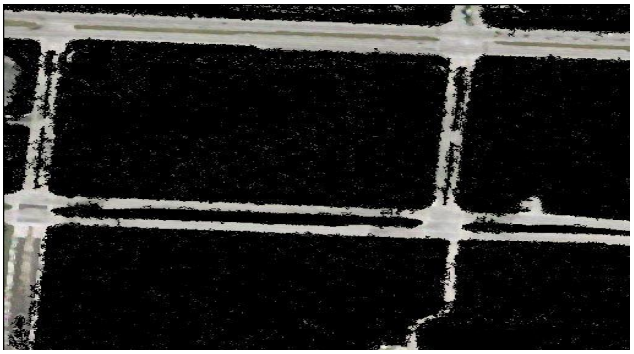

Figure 7: ROI extracted

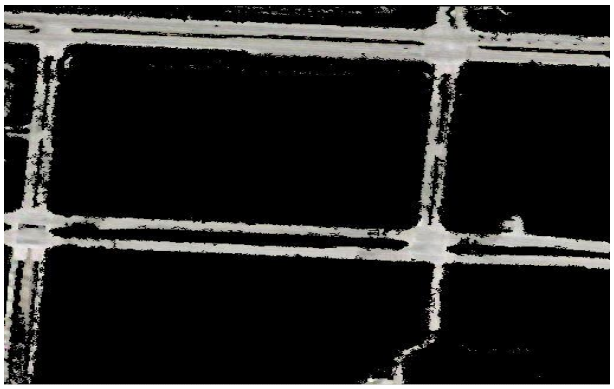

Figure 8: Enhanced image

4.2. Switching bilateral filter

Switching Bilateral Filters are used to remove all kinds of universal noises (see Figure 5) such as salt-and-pepper, gaussian noise and impulse noise. In switching scheme, the noise detector searches for noisy pixels in a corrupted image and tries to distinguish them from uncorrupted ones. It has to be capable of keeping the details and edges in an image when noise is detected. It provides a sharper image than a other filters. Thus, denoised image (see Figure 6) are obtained from the SBF which is given as an input image for ROI extraction.

4.3. DWT and SWT wavelet transform

To enhance the ROI extracted image (see Figure 7) by using wavelet (DWT and SWT) transforms. The DWT has been employed in order to preserve the high frequency components of the desired image. The output of each level of SWT contains the same number of samples as the input. The high frequency subbands obtained by SWT of the input image are added into the interpolated high frequency subbands. In parallel, the low frequency subband of SWT and DWT goes through the singular value equalization process. Hence after IDWT, the desired output image will be sharper with good resolution and contrast (see Figure 8).

5. Evaluation and Performance

Compare FDA-SRD model with the existing color-based segmentation method,using a simulator in MATLAB.First,we consider the FDA-SRD model with median filters and compare with SBF,using same simulator.Similarly,the image ratio of DWT and SWT can also be simulated.

Road Images	Median filter	SBF
Image1	39.84	41.11
Image2	40.00	41.26
Image3	40.68	41.01
Image4	40.40	41.50

Table 1: Comparison of existing and proposed denoising method (PSNR(dB) value)

Road Images	Color Segmentation	ROI
Image1	43.49	44.39
Image2	43.68	44.32
Image3	43.01	44
Image4	43.40	44.92

Table 2: Comparison of existing and proposed segmentation method (PSNR(dB) value)

Road Images	DWT	DWT& SWT
Image1	77	83
Image2	77	85
Image3	76	84
Image4	79	87

Table 3: Comparison of existing and proposed enhancement method (PSNR (dB) value)

6. Acknowledgments
Our sincere thank to Nehru College of Engineering And Research Center, Pampady for providing the technical support.

7. Conclusion
The FDA-SRD model is proposed and validated. This model along with switching bilateral filter and wavelet transforms gives visually and logically good result. This model solves the problem of computation efficiency for remote sensing image processing.

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