Implementation of Discrete Wavelet Transform and Threshold Decomposition Driven Morphological Filter for Satellite Image Enhancement

Ankit Dable, Shashank Ranjan, Veena Deshmukh, Bhushan Kawale, Paritosh Nandanwar, Sonali Wakekar
ankit.dable@ymail.com

Abstract-Satellite color images are being used in many fields of research. One of the major issues of these types of color images are their poor perception. In this letter a new method to enhance the satellite image using the concept of wavelets and threshold decomposition. The proposed enhancement technique uses DWT to decomposed input image into different sub bands. Threshold decomposition is powerful theoretical tool, which is used in nonlinear image analysis .Detecting the positions of the edges through threshold decomposition and these edges are sharpened by using morphological filters. This method will give better qualitative and quantitative results.

1.INTRODUCTION

Satellite Image enhancement is the technique which is most widely required in the field of image processing to improve visualization of the feature. In general, the popular edge enhancement filtering is carried out with the help of traditional filters. But these filters do have some problems, especially while enhancing a noisy image. The effort on edge enhancement has been focused mostly on improving the visual perception of images that are unclear because of blur.

Noise removal and preservation of useful information are important aspects of image enhancement. A wide variety of methods have been proposed to solve the edge preserving and noise removal problem. Wavelets are also playing a significant role in many image-processing applications. The 2-D wavelet decomposition of an image is performed by applying the 1-D discrete wavelet transform (DWT) along the rows of the image first, and then the results are decomposed along the columns. This operation results in four decomposed sub-band images referred to low-low (LL), low-high (LH), high-low (HL), and high-high(HH) .The frequency components of those sub bands cover the full frequency spectrum of the original image then Threshold decomposition is a powerful theoretical tool, which is used in nonlinear image analysis. Detecting the positions of the edges through threshold decomposition and these edges are sharpened by using morphological filters.

This method will give better qualitative and quantitative results. The result image will be evaluated with two characteristics, distortion and sharpness so that signal to noise ratio become high which indicate the better quality of the image.

2. TECHNIQE USE

A. Discrete wavelet transform

The 2-D wavelet decomposition of an image is performed by applying the 1- D discrete wavelet transform (DWT) along the rows of the image first, and then the results are decomposed along the columns. This operation results in four decomposed sub band images referred to low-low (LL), low-high (LH), high-low(HL), and high-high(HH).The frequency components of those sub bands cover the full frequency spectrum of the original image.

DWT separates the input image into different sub band images, namely LL, LH, HL, and HH. DWT has been employed in order to preserve the high frequency components of the image. The input low contrast color image is decomposed into R,G,B.

DWT is apply to each color(R,G,B) separately . The LL sub band of each color component of the image is decomposing into a series of binary levels, each of which may be processed separately. These binary levels can then be recombined to produce the final gray scale image with identical pixel values to the produced by gray scale processing.

B..Threshold decomposition

The enhancement is applied through a framework of threshold decomposition has two advantages: it reduces the edge detection to a simple binary process; and it makes the estimation of edge direction straightforward. Edge detection and direction estimation may be carried out by identifying simple patterns, which are closely related to the Prewitt operators. The success of threshold decomposition ,gradient-based operators is used to detect the locations of the edges, by detecting the positions of the edges and then applying a class of morphological filtering. A gray scale image f(x) can be decomposed in many binary images (*cross sections*) by thresholding it at each gray scale level. A cross section at level t is given by the set of all pixels greater or equal *t*.Any gray scale image can be uniquely reconstructed from its cross sections.

C..Morphological filtering

A morphological filter is used to sharpen these detected edges. These detected edges were then sharpened by using some morphological filters. Binary morphological operations of dilation and erosion are used to increase the contrast in the region and direction of the detected edges with the aid of a flat structuring element. The edge detected guided smoothing filters succeeded in enhancing low contrast satellite images. This was done by accurately detecting the positions of the edges through threshold decomposition.

3.Performance Analysis

The result image can be evaluated with two characteristics, distortion and sharpness. According to the distortion evaluation, adjusting errors are required, by computing the Mean Square Error (MSE). Mean square error has been the performance metric in lost performance. Peak Signal to Noise Ratio (PSNR) adjusts the quality of the image which the higher the PSNR refers to the better quality is the image. Peak signal to noise ratio (PSNR) and root mean square error (RMSE) have been implemented in order to obtain quantitative results.

REFERENCE

[1] "Discrete Wavelet Transform-Based Satellite Image Resolution Enhancement" by P.
Karunakar, V. Praveen and O. Ravi Kumar

[2] "Satellite Image Resolution Enhancement using DWT Technique" by O.Harikrishna, A.Maheshwari.

[3] "Brightness and Resolution Enhancement of Satellite Images using SVD and DWT" by Ammu Anna Mathew , S. Kamatchi

[4] "Satellite Image Enhancement Using Discrete Wavelet Transform and Threshold Decomposition Driven Morphological Filter" by R.Thriveni and Dr.Ramashri.