EDGE DETECTION IN MULTISPECTRAL IMAGES BASED ON STRUCTURAL ELEMENTS

Mehdi Ghasemi Naraghi[1], Mahdi Koohi[2], Abbas Shakery[3]

[1]Islamic Azad university, Islamshahr Branch, Islamshahr, Iran
ghasemi@iiau.ac.ir
[2]Azad University of South Tehran
m.kohy@yahoo.com
[3]Azad University of South Tehran
a.shakery@gmail.com

ABSTRACT

One of the first steps of feature extraction is edge detection. There are various methods for edge detection such as sobel operator, log method and canny operator. These methods have disadvantages such as create noise and discontinues edge and image smoothing. With the notice of the daily growth multi spectral images processing and describe of these images have become very important. Because of the existence of many details of these images, necessity to robust algorithms caused to present a method to extract feature of an object. In this article An improve method for edge detection has been purposed. In this method edge is detected by morphology's operator and their combination and with the use of various structure elements of images in satellite and remote sensing.

KEYWORDS

Satellite, Image Processing, Edge Detection, Multi spectral

1. INTRODUCTION

Edge detection is a very important topic in the processing of multi spectral remote sensing images. Many edge detection techniques are available in the literature. A number of recent edge detectors are multi scale and include three main processing steps: smoothing, differentiation and labeling . Segmentation of images is a related topic, and entails the division or separation of an image in to regions of similar attribute. Because of many uses of satellite's images in the recent year using of them has developed. Processing satellite images in geology users increase of geography information in number formats for making it understandable for users and extracting few information and solving existing problems have been used. One of the uses that can be done from processing is extracting purposes and different objects and these purposes and objects can be natural (mountain, desert, lake, etc) artificial or man-made (roads, places, electricity lines, urban areas, etc). Processing and interpreting these images on specific features concentrated to achieve our purposes [7]. In this paper the problems of the method have been solved and good algorithmic on the basis of morphology operators have been presented. In the second section, primarily it has been spoken about the method s of extracting the satellite images. In the third

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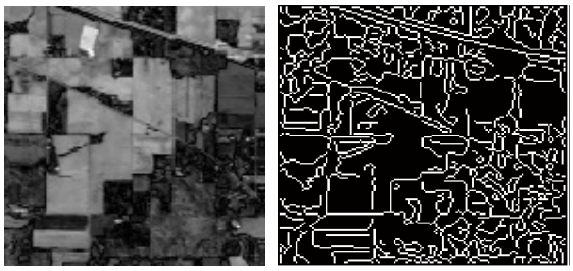
section a suggested method for satellite images edge detection has been explained and the fourth section is includes the result of demodulation and the fifth section result is included.

2. METHODS OF FEATURE EXTRACTING IN SATTELITE IMAGES

Two ordinary methods that can be used for explaining images are such as: 1.Spectral method 2.Place method in spectral method reflexion of electromagnetic wave that have been shone on objects and difference of the waves latitudes signal reflexes information about the kind of quality, situation and sources situation and different objects on earth have been extracted. In second method the information about the necessity of the object features has been extracted that the most important ones are shape, color , theme , contextual , size that each of them are used in their specific methods and have classic steps is description satellite images is object recognition.
In this article the primary steps of shape recognition that is edge detection is discussed. If use the shape feature forachieving information it should be achieved dimensions and peripheral of shape. Extracting shapes is usually on the basis of borders – areas – geometric changes. And the initial step for analyzing and extracting image is classifying. With the combined image is divided in to its combined parts. And the size of classifying depends on the topic it means that when the favorite object is departed the classifying should be stopped. Generally classifying is the hardest work in processing pictures. In this step the probable success and failure is defined. Algorithms of classifying one colored images, is usually based on one of the two main property of gray-scale : discontinuous and similarity. In the first group the image is classified on fast gray changes. Main topics in this group are making detection of single points and edge's image and the purpose method. The main technique in the second group is threshold, the area growth and dividing. In this article the first step is discussed. The basic theory in the most making edge detection methods is calculating a local derivative operator we can use the magnitude of the first derivative for defining whether the pixel is on the edge or not and the second derivative for defining whether the pixel on the edge is on the dark or bright side. Several methods are in this field that we talk briefly about them [8]. Sobel operator is one of the edge detection methods as observe in the Fig (1) both do the influence of deriving and smoothing but in fact observe a lot of discontinuances in the figure. The Laplacian operator is very sensitive to noise and produces double edges and is not able to appear the direction of the edge to show that a pixel is on the dark or bright side(Fig1)[9].Another method is using Canny operator. This method the necessary steps for smoothing and edge detecting are done together. Although this method better results are included for edge continues and but so observe noise in the parts of image. On the other hand it has more calculating than the former methods (Fig.1).In fact for reasons like noise, breaks borders that is because of heterogeneous bright and other factors that make unnatural not allied seldom these methods show a complete border, so in following of obvious algorithmic edges detection algorithm and showing other edge linking algorithm should also be done. In this way processing of the action of calculating becomes more and this is the disadvantages of these kinds of methods [1].in [12] a method offers that is used wavelet domain and in this method has developed a representation combined dyadic wavelet transform of Mallat with first fundamental form to detecting multi scale edge features of multispectral image. And numerous experiments are taken by using the algorithm to detect multi scale edge feature of multispectral images. This method is good result but it is computational method for computed wavelet weights.

3. SATELLITE IMAGES EDGE DETECTION

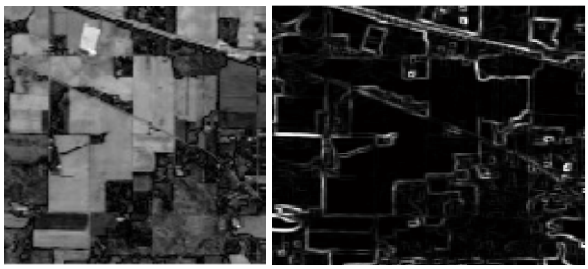
In satellite images because of the existence of many features and objects with different shapes and sizes it is necessary that the extracted edges to be connected completely otherwise if these edges and borders to be broken very much it may be considered an object which this problem is included in the mentioned methods .On the other hand the amount of the noise should be considered. Because noise can omit a part of the shape or add a part to it. For edge detection of multi spectral images Cumani method is used. In this method the PCA algorithm is used to decrease the number of spectral.[11]This method has good results but effective of noise environments and is complex computation Fig(1).



Original image Cumani method

Fig (1).use of Cumani method.

The other method for edge detection is criterion Euclidean this method should combine with other techniques such as vector angle based technique to give acceptable results so the cost of computation increase Fig (2). In [10] presented a method for measurement smoothness of images beneficial of Gradient operators and Euclidean criterion but edges detected are not continued and noise sensitive.



Original image Euclidean criterion

Fig (2).Use of Euclidean criterion

3.1. Edge Detection Based on Morphology Filters

In this part we talk about the descriptions of morphology operators dilation and erosion are two Basic morphology operators that other morphology operators are often received from their combination. If A is a white and black picture and B is a structure element the dilation of the base of B on the image of A is shown [4]:

$$(A \oplus B)(x, y)=\max\{A(x-s, y-t)+B(s,t)\} \quad (1)$$

Dilation is an operator that grows and thickens the objects in a binary image. Erosion operator is explained below for A, B sets:

$$(A\Theta B)(x,y) = \min\{A(x+s, y+t) - B(s,t)\} \quad (2)$$

Erosion makes small or makes the around of an image thin. Like dilation operator the how and the amount of the erosion is controlled by the structure elements. Opening operator on the A set by means of structure elements B with the relation of AoB is describe below:

$$AoB = (A \oplus B) \oplus B \quad (3)$$

Closing operator makes smooth for some parts of the periphery but on the contrary the Opening operator usually mixes the broken hybrids and omits the small details and fills the spaces of objects periphery classing operator on A and B sets is described follow:

$$A\Theta B \subseteq A \subseteq A \oplus B$$
$$A \circ B \subseteq A \subseteq A \bullet B \quad (4)$$

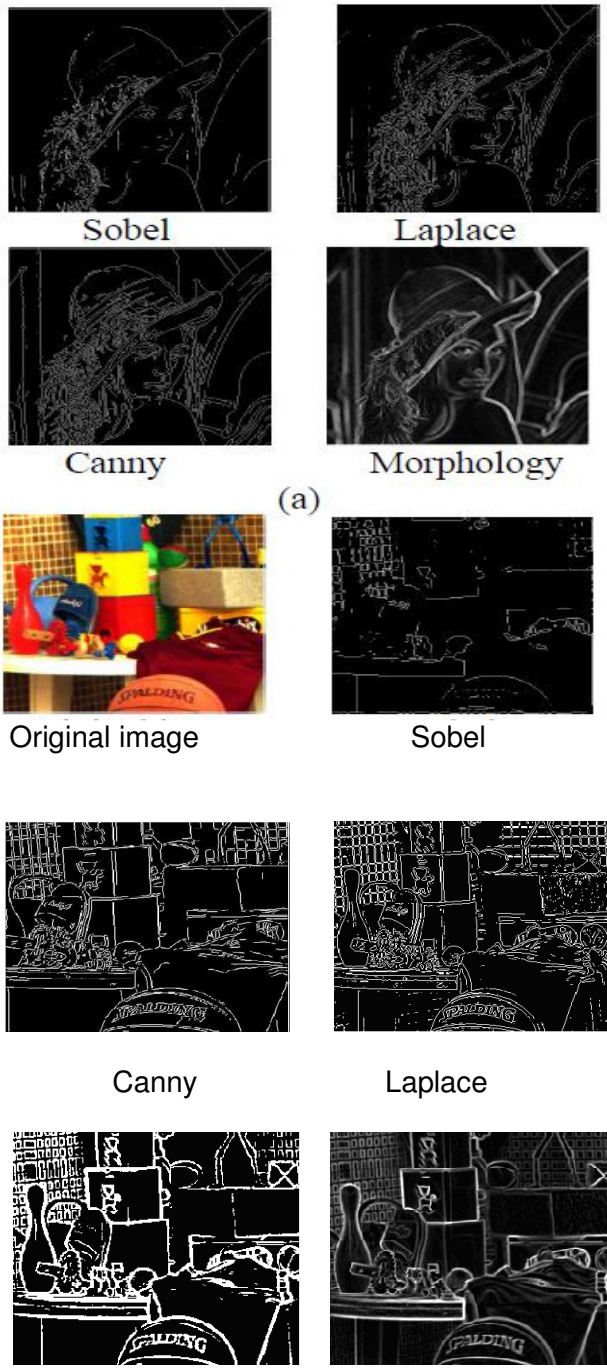
Morphology edge detection algorithm uses basic operator such as closing, opening, dilation, erosion described below:

$$E_d(A) = (A \oplus B) - A$$
$$E_e(A) = A - (A\Theta B) \quad (5)$$

Ed (A) is an image edge which is achieved by using the subtract of dilation image from the main image and Ee (A) is the subtraction of the main image from erosion image [2].
With noticing the former relations we observe that dilation and closing make the shape of the image big where as erosion and opening makes the shape of the image small so we can use these exclusivity for finding the edges[3].Morphology gradient of the image is like below:

$$G(A) = (A \oplus B) - (A\Theta B) \quad (6)$$

Fig (3) presents result of the comparison between this method and other methods for Lena image (Fig.3 (a)) and one sample of multi spectral image (Fig.3 (b)) shown.



(b)

Fig.3. Comparison of traditional technique and morphology method.

4. THE PURPOSED METHOD FOR SATELLITE IMAGE EDGE

DETECTION

In this method, morphology Reconstruction operator for processing and omitting noise is used after that use closing operator and dilation of the images that is smooth. With the notice of using structure elements and achieved experimental results on this method observe that the bigger sizes of structure elements become thicker the achieved borders will have but it has this point in mind that if the size of structure element biggest excessive than enough causes standard and elongation of the borders which will not have a favorite result. In the purposed method in comparison with the mentioned methods the results have become better the structure elements in the shape of a circle and square will have better results than other structure elements in satellite images. In satellite images which have more details getting good edges, the smooth image subtract from the above processing before the dilation operation. Fig (4) presents flowchart of the Algorithm [6].

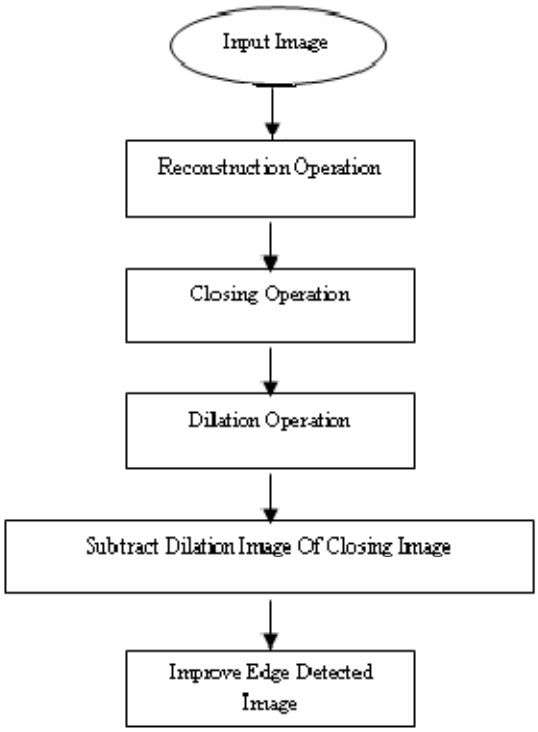


Fig.4.Flow chart of purposed algorithm

For A and B sets achieve purpose method below [5]:

$$A_1 = (A \oplus B) \quad (7)$$

$$A_2 = R_A(A_1) \quad (8)$$

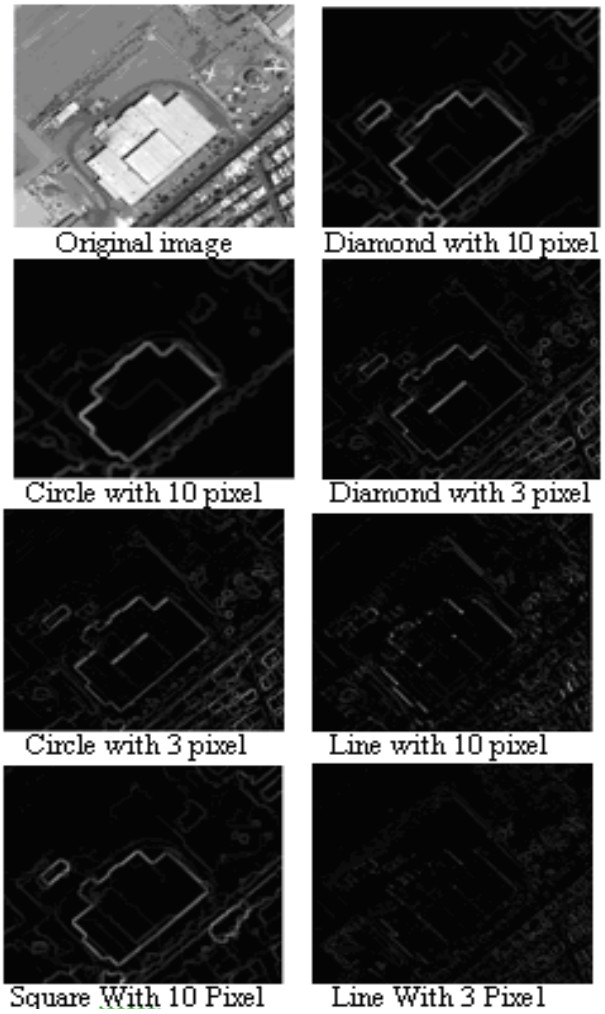
$$A_3 = (A_2 \oplus B) \quad (9)$$

$$A_4 = R_{A_2}(A_3) \quad (10)$$

Where R_A is Reconstruction in the 8^{th} relation.

5. IMPLIMENT RESULTS

In this section primarily the gives which are used is introduced, then the results of the tests done is presented. Fig (5) presents use of different structure element. In this article the two categories given are used, Lena image which is from the existing software and the second section given satellite Quickbirde carefully 60 * 70 cm for a town zone next to the airport which has different purposes and objects such as buildings in different dimensions airplane, automobile, etc. In figure 5 the difference between usual methods and purposed method has been shown (sobel , canny, laplacian, methods). In this figure noise and discontinuously edges are observable but in purposed method noise and discontinuously is lesser. and in circle and square structural element are best result than other structural elements.



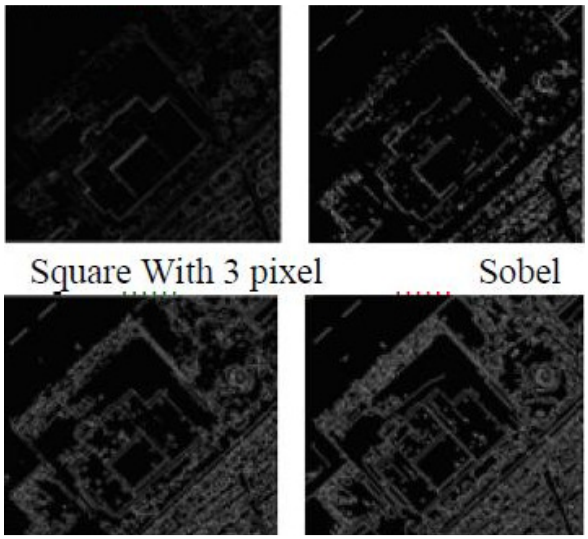


Fig5.Purpose Algorithm Result and Comparison Various Structure Elements with Various Pixel Number And Sobel, Laplace, Canny Operators

DONE TESTS

In this section the tests done on multi spectral images which are mentioned accompanied by the main image and image operation of the canny operator is shown and observed (Fig 6). The shown edges in the purpose edges method have better quality in images which have small details and more, by choosing suitable structure elements and even combining these we can receive better edges with more and higher quality.

Original Image

Canny Operator

Morphology Operator

Fig.6.Comparison between Purpose Method and Canny Operator (Canny Operator Presented Better Result than General methods)

CONCLUSION

With the notice of the existing methods for edge detection in different images especially images such as multispectral .It seems that images should use a method that can decrease the noise existing in detected edges and show more continuously edges. In the presented method in this article we have achieved the importance of using this method for a suitable structure element the researches done in the circle structure base and square have shown the best consequences. The clustering stage is followed by the gray level edge detection stage (Canny). The resulting edge images show that the performance of the proposed method is superior to one stage edge detection with wellknown edge detectors.

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