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# Augmentation of Colored Satellite Imagery by Means of Vector Field Method

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***Abstract:*** *A Multispectral image is modeled as vector field with a number of dimensions equal to the number of bands in the image. In this model pixel is defined as a vector composed of a number of elements equal to the number of bands. It is often necessary to enhance multispectral radiance or reflectance data to create an image that is suitable for visual interpretation. A general method is needed that works for any number of bands, with no parameters and a reasonable computing time. To fulfillthis goal. contrast stretch models a multi-spectral image by means of vector field. The dimension of this filed equals the numberof bands of the image. Such an evaluation includes qualitative and quantitative analysis which will show clear improvements compared to state-of-art methods.*

***Keywords:*** *Edge Detection, Multispectral Image, Edge Enhancement, Vector Operator.*

## I. INTRODUCTION

Edge detection has been helpful for gray-level and color images using a number method. Edge detection is a common imageprocessing approach that often forms the first stage of image interpretation, and recent attention has been given to the developmentof color edge detection operators. The benefit of colored edge detection schemes over gray scale approaches is easily illustrated byconsidering the fact that the edges that exist at the boundary between regions of different colors cannot be detected in grayish scaleimages if there is no change in intensity. This paper has a new color edge sensor that has a single channel form original to themorphological grade(2) and, therefore, avoids the need for any image smoothing which is perceptually not a well- defined operationfor color images.

Gradient estimation is an essential task in image processing and scene analysis. The gradient in grey scale images can be thoughtof as the change in the gray-level, but in color images, the “color gradient” is defined based on the change in the color vector. Inother words, besides the intensity of a color pixel, its hue and saturation must be taken into account. Various types of gradientestimators for color images have been proposed in the literature. From a general point of view, these methods can be divided intotwo major categories: directional difference (or gradient vector based) operators and non-directional difference (or gradientmagnitude based) operators. Edge is one of the most fundamental and important features of image. Edge detector is one of the mostimportant tools in image processing [3]. Efficient and accurate edge detection will directly work on the understanding of machinevision system to objective world.

A synthetic method is discussed to detect edges in color images with an improved Kuwahara filter to smooth the original image andafter that an auto threshold algorithm and thinning technique are applied to generate the final edge detection image. Imageprocessing and computer vision have robust methods for feature extraction and the computation of derivatives of scalar fields.

Furthermore, interpolation and the effects of applying a filter can be analyzed in detail and can be advantages when applying thesemethods to vector fields to obtain a solid theoretical basis for feature extraction. By means of a vector field we model a multispectralsatellite image. The dimension of this fields is equals the number of the bands of the image. Vector operators upon these fields canbe applied. Results obtained are compared with the conventional edge operators Evaluation includes qualitative and quantitative analysis and it shows a clear improvement with respect to conventional edge operators.

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Table 1 Basic parameters of multi spectral images.

| | ASTER | IKONOS |
|---|---|---|
| Acquisition date | July 7, 2003 | June 14, 2006 |
| Pixel size ($m^2$) | 15 · 15 | 4 · 4 |
| Dimension (pixels) | 500 x 500 | 1200 x 1200 |
| Bands (μm) | 1) 0.52-0.60<br>2) 0.63-0.69<br>3N) 0.76-0.86<br>3B) 0.76-0.86 | 1) 0.45-0.52<br>2) 0.52-0.60<br>3) 0.63-0.69<br>4) 0.76-0.90 |

In a multispectral image, the information content of the edges varies through bands. Both images cover a portion of mexico citywhere the runways of an airport are clearly visible. One image is formed by the visible and near infrared (VNIR) bands of theadvanced spaceborne thermal emission and reflection radio meter sensor (ASTER) on board terra satellite.(FIG 1). The Four bandsof the IKONOS sensor (fig 2) from the other image. These images are not precisely orthorectified.

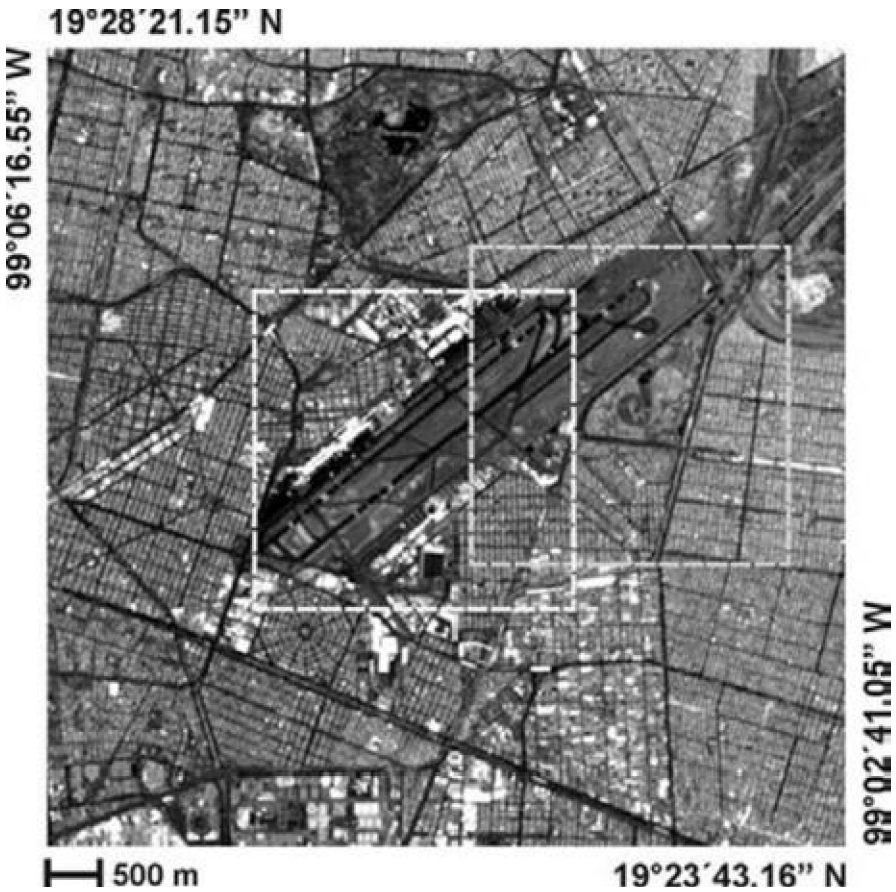


Fig 1. First principal component of ASTER Image.

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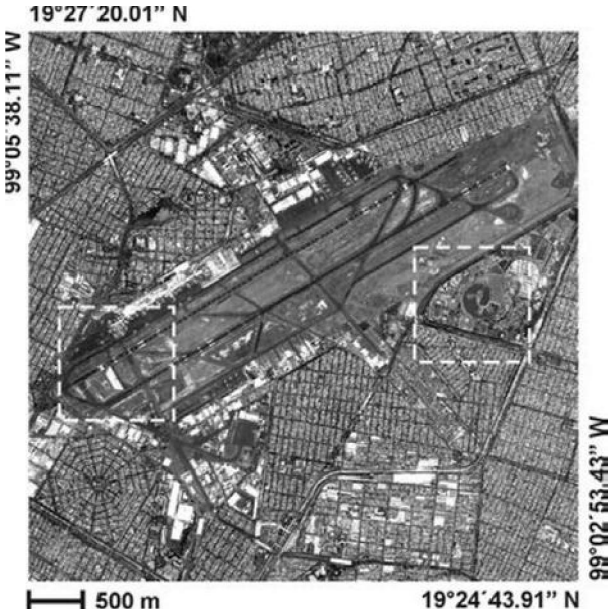

Figure 2. First principal component of IKONOS image.

The rest of the paper is organized as follows. We provide details of our system's architecture flow in Section II. Section III depictsthe obtained results and its discussion and Conclusion is then given in Section IV.

## II. SYSTEM ARCHITECTURE

Below fig shows the architecture of the proposed method. Initially a multispectral image of n band is given as input, then ndimensional vector is constructed after that multispectral gradient and laplacian methods are applied in parallel. On the generatedvector field apply FT then IFT and we get the multispectral lapacian.

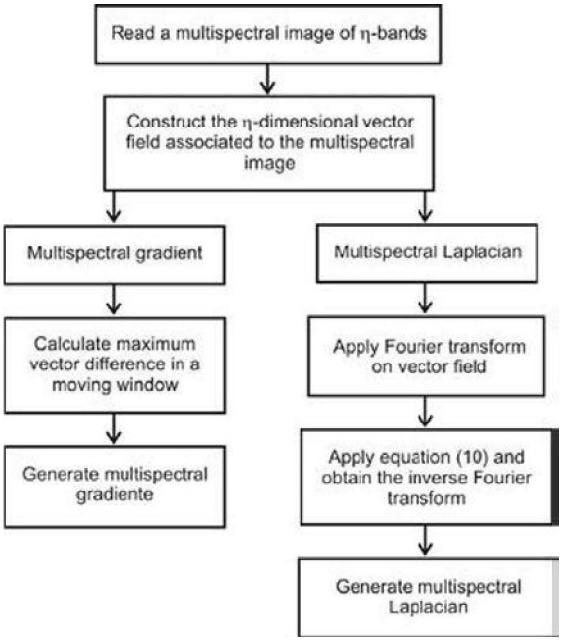

Fig. 3: Flow Chart of Proposed System

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### A. Qualitative Evaluation

We display in a high-resolution monitor the edge enhanced images. We display as well the first principal components of both theimages. Visual Inspection is carried out. On the grounds of previously published work on qualitative image evaluation each edgeenhancedimage was rated according to the following qualitative criteria: general quality, sharpness,contrast, and noisiness the number of gray levels and edges were evaluated. Most of the variance is accumulated by the firstprinciple component of the images. The edge enhancement with this component is compared. The reason for of this comparison isto evaluate, according to the criteria, the degree of edge enhancement with respect to the original edge information content of theimages.

### B. Quantitative Evaluation

Several indicators to perform a slope of an edge are used. Slope – the more steepness the better the definition of the slope. Widening– a width as close as possible to the original edge the better. Spatial location – the closest of the enhanced edge to the originallocation the better. Contrast – the highest the contrast the better. With the help of a cursor, a line of the image is selected. There aremany types of edges in the images. To obtain a coherent quantitative evaluation of edges, we considered three types that occurfrequently in the images.

## III. RESULTS

Two mosaics were prepared to show the results of Canny and Cumani operators we applied a histogram saturation transformation tothe images of the mosaics for visuals appreciation purposes. An inspection of results shows an enhancement similar to the soberoperator(fig4). There are two limitations to the Canny and Cumani operators. The first one is that they carry a number of parametersthat need to be defined by experimental procedure. The second one is that they work for RGB color generalization exists for anarbitrary number of bands of a multispectral image.

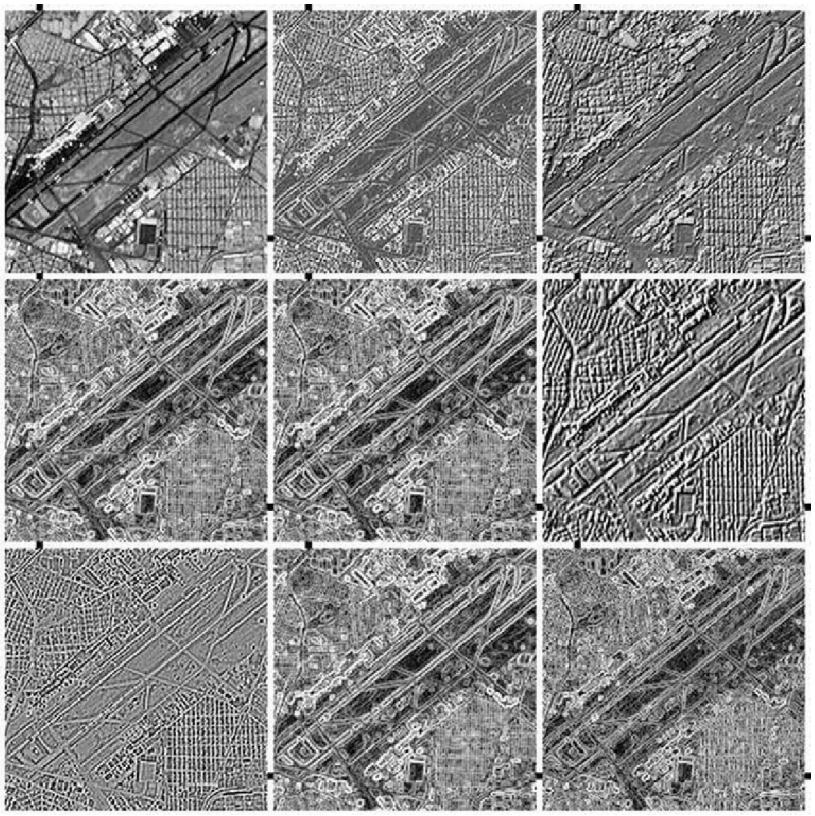

Fig. 4: Mosaic ASTER A

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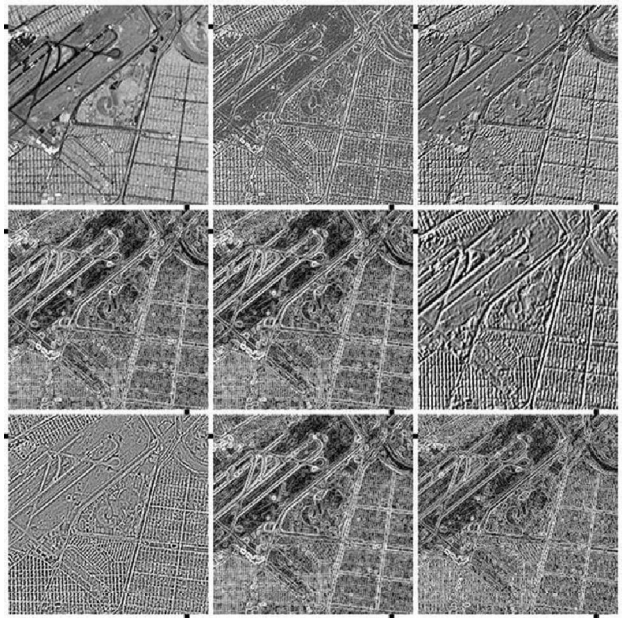
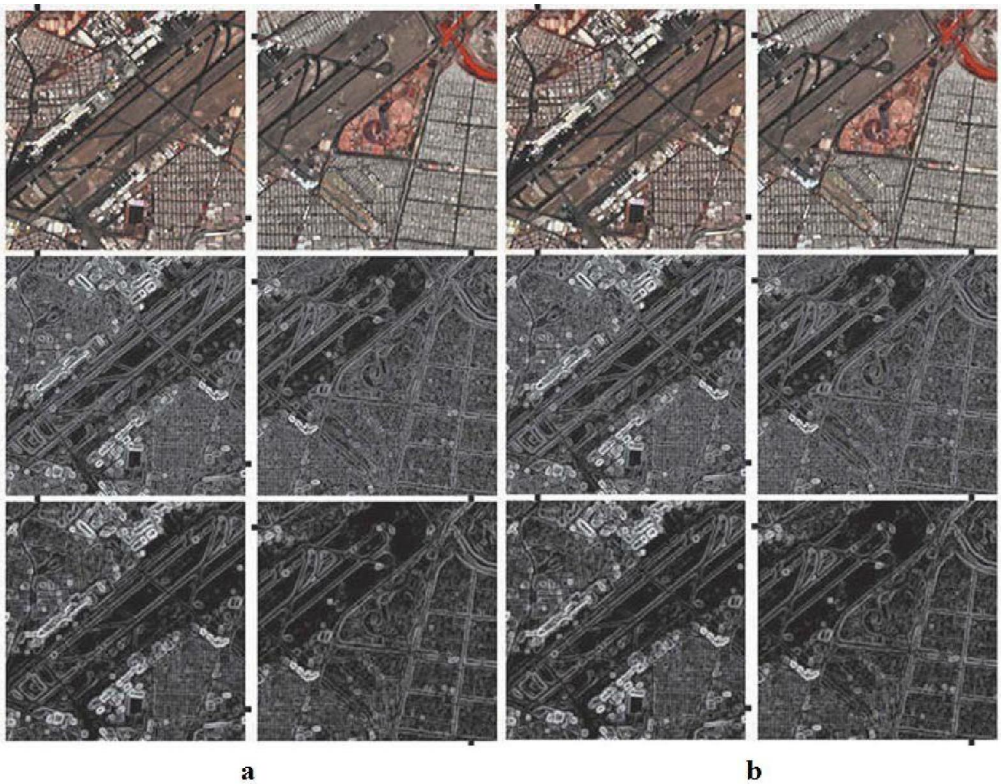


Fig.5 Mosaic ASTER B



a b

Fig.6 (a) First row, RGB color composite of the first three band of aster image. Second row edge enhancement from canny operator,third row edge enhancement from cumani operator. (b) First row RGB color composite of the first three bands of IKONOS image,second row edge enhance of canny operator, third row edge enhance from cumani operator.

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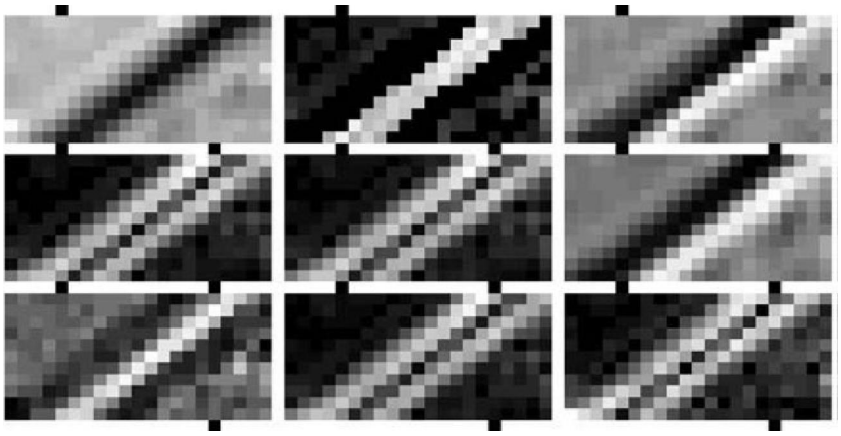

Fig.7 Mosaic of strips from line 91 column 118 and angle 135 from Aster image

## IV. CONCLUSION AND FUTURE SCOPE

Two methods to extract edges from multispectral images are designed and discussed in this research. Such methods require themodeling of the original multispectral image as a vector field. Upon this vector field, two vector operations are applied to extract theedge content originally distributed through the bands of the images. These methods are parameter-free. A qualitative andquantitative evaluations shows that that our methods perform better than widely used edge enhancement procedures. The basicreason for this is that our methods extract the edge-content distributed through the original bands of a multispectral image.

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