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# An Adaptive Edge Detecting Method for Satellite Imagery Based on Canny Edge Algorithm

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***Abstract***— *Satellite images are unclear and it is very difficult to get information from them. This paper deals with the detection of edges of a satellite image. Here, edge detection is the fundamental tool of image segmentation. Image segmentation is a process of dividing an digital image into set of pixels, it is used to identify the objects and boundaries un an image.A set of connected pixels which forms boundary between two disjoint regions defines an edge,which is very important to acquire information from an image.There are many segmentation techniques like threshold, clustering, PDE, ANN based techniques, of all these methods edge based technique is the most optimum one. Canny edge detection algorithm is used to detect a wide range of edges in image uses multi-stage algorithm. Low error rate,good localization and single response are the main features of this algorithm.*

***Keywords*— Image segmentation, Canny edge detection technique, satellite images.**

## I. INTRODUCTION

Image processing is used to analyze and manipulate the images based on different purpose, the output of the image processing may be the image or any characteristic of that image. Edge detection is one of the well-developed field in image processing .This includes a variety of mathematical methods which are used to identify the points in digital image.There are many edge[3] detecting techniques like clustering, thresholding, compression based methods etc.,Most of the information about images will be found in detecting the edges. So, we detect the edges in image using filters which enhances some areas of image which contain edges, thereby sharpness of the image[1] will increase and image will appear clear.

**IMAGE SEGMENTATION:**

Image segmentation is a process of dividing the digital image into very smallest parts called pixels or image objects. If the pixel of an image is high, the higher the quality of the image. The three basic categories[9][10] of image segmentation are

A. Structural segmentation techniques: This technique relies upon the required region which is to be segmented.

B. Stochastic segmentation techniques: These techniques works on the discrete pixel values of the image

C. Hybrid techniques: These techniques uses discrete pixel and structural information together[11].

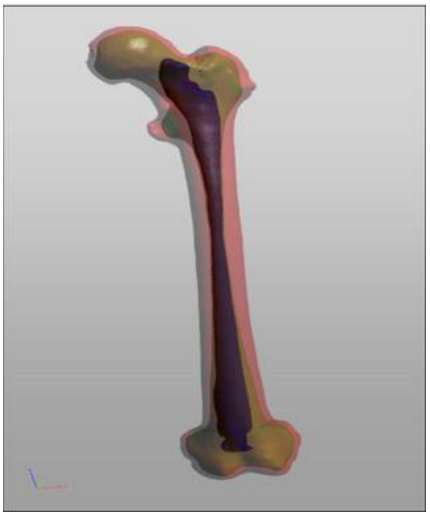

*Fig.1: A segmented left human femur. Red colour indicates the outer surface, Green colour indicates the surface between compact bone and spongy bone, Blue colour indicates the surface of the bone marrow .*

There are many image segmentation techniques[12] namely:

1. Edge based methods
2. Threshold method
3. Clustering[8] based method
4. PDE based method
5. ANN based method

**EDGE BASED METHODS:**

Edges are the most significant part of an image[2],it is the primary source of recovering information from images.Most of the information about an image lies in edges.It works by detecting discontinuities in

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brightness.Edge detection is the abrupt change in image intensity. There are basically two types of edges namely horizontal and vertical edges .An edge operator is a neighborhood operation which determines the extent to which each pixel's neighborhood can be partitioned by a simple arc passing through the pixel. Pixels in the neighborhood on one side of the arc have one predominant value and pixels in the neighborhood on the other side of the arc have a different predominant value .Edge detection operator needs to be chosen to be responsive to gradual change[4].

Applications of edge detection include:

- Fingerprint detection
- Satellite images edge detection
- Robotics vision
- Medical science

*Fig.2: Image showing edge detection of a flower.*

Types of edge-based methods:

- Robert's edge detection,Sobel edge detection ,Prewitt edge detection,Krish edge detection,Robinson edge detection, LoG edge detection and Canny edge detection.
- Prewitt edge detection method: In this by using difference between corresponding pixel intensities of an image edges are calculated.
- Sobel edge detection method: This operator is same as prewitt operator the major difference is that the coefficients of masks are not fixed.

**CANNY EDGE DETECTOR:**

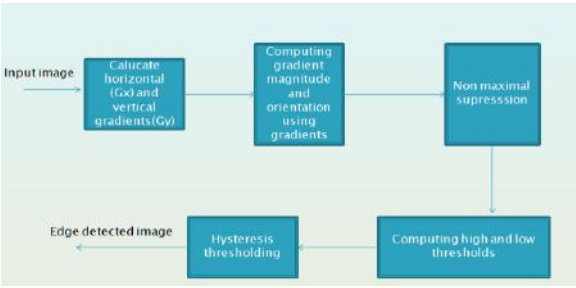


*Fig.3: Block diagram of canny edge detector.*

**BLOCK DIAGRAM DESCRIPTION:**

Step 1: Computing the horizontal (Gx) and vertical (Gy) gradient of each pixel in an image.

Step 2: Using the above information the magnitude (G) and direction (of the each pixel on the image is calculated.

Step 3: In this step all non-maxima's are made zero and suppressed.

Step 4: The high and low thresholds are measured using the histogram of the gradient magnitude of the image.

Step 5: To get the proper edge map hysteresis thresholding [5-7] is employed which will link between the weak and strong edges. The weak are taken into consideration if and only if it is connected to one of the strong edges or else it is eliminated from the edge map.

**SATELLITE IMAGES:**

- Satellite images give a good representation of what is happening at every point in the world, especially overoceans where large gaps in data occur. Color images are due to the grey level [13].
- The resolution of satellite images varies depending on the instrument used and the altitude of the satellite's orbit.
- Earth's surface at various spectral, temporal, radiometric, and increasingly detailed spatial resolutions as is determined by each collection system's sensing device, and the orbital path of its reconnaissance platform are depicted by satellite imagery.

## II. EXPERIMENTAL RESULTS

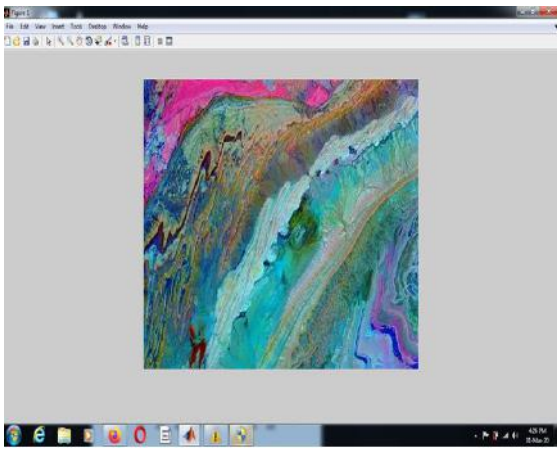

*Fig.4: Original satellite image*

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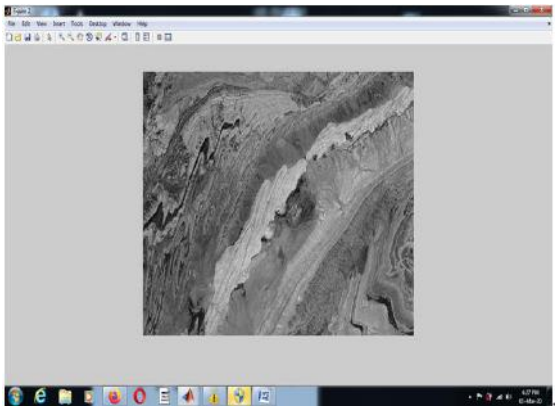

*Fig.5: RGB to gray converted image*

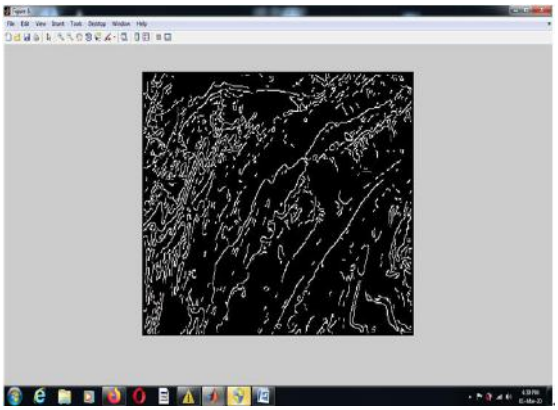

*Fig.8: Thresholding using 8-connected components*

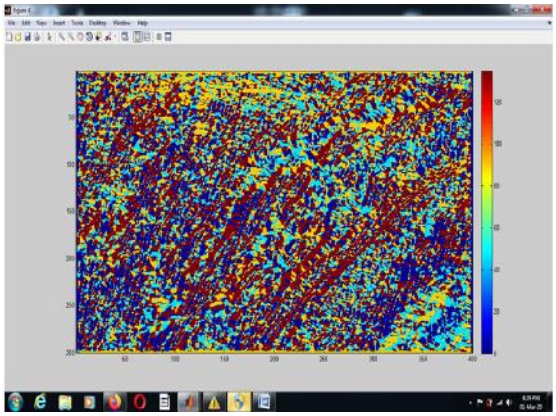

*Fig.6: Adjusting the direction to nearest 0,45,90 or 135 degrees*

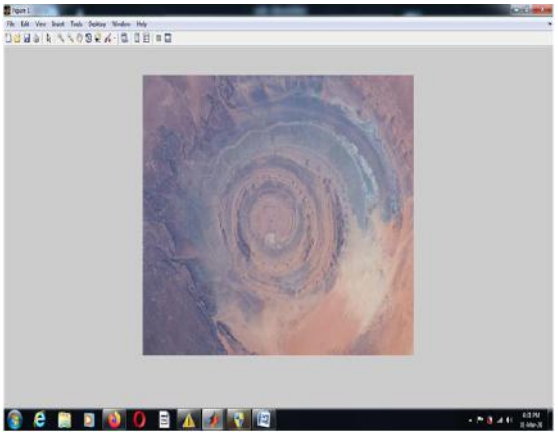

*Fig.9: Original satellite image*

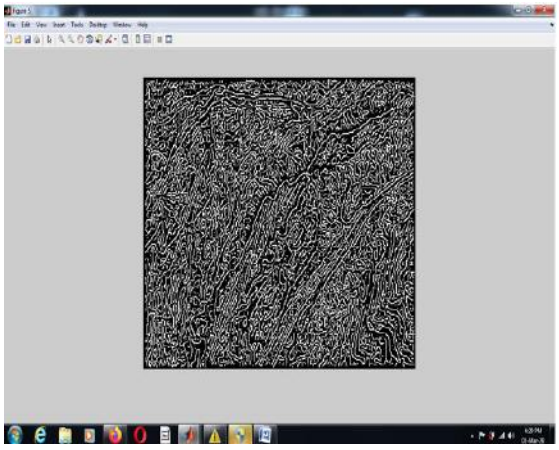

*Fig.7: Calculation of magnitude and non-maximum value suppression*

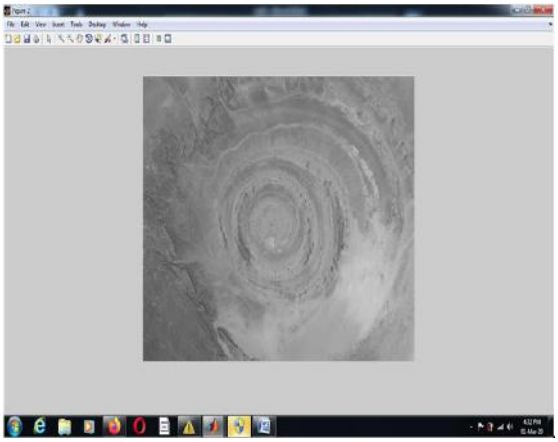

*Fig.10: RGB to gray converted image*

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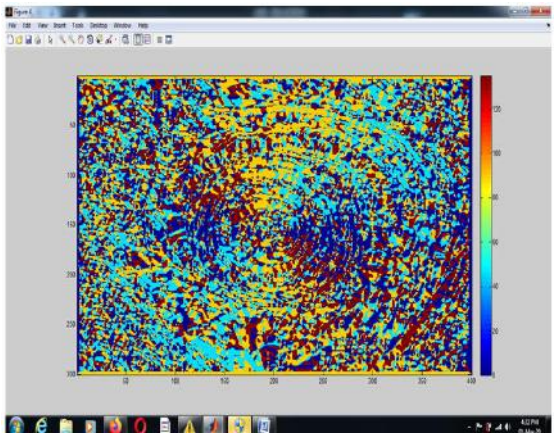

*Fig.11: Adjusting the direction to nearest 0,45,90 or 135 degrees*

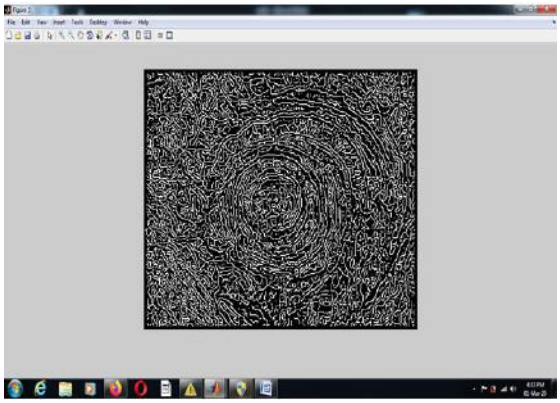

*Fig.12: Calculation of magnitude and non-maximum value suppression*

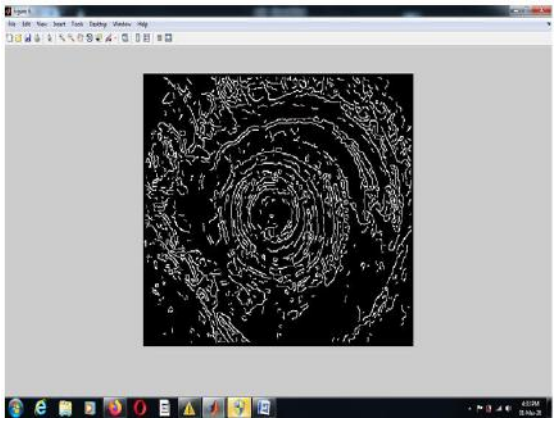

*Fig.13: Thresholding using 8-connected components*

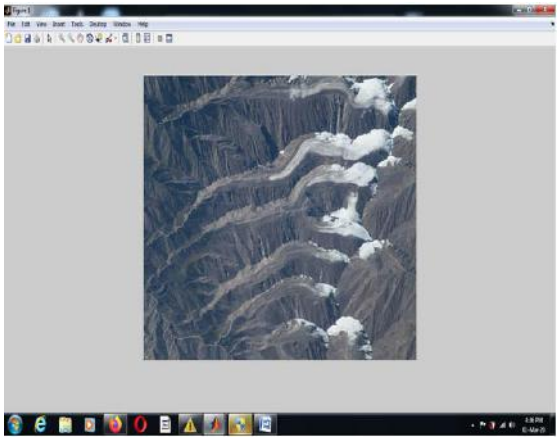

*Fig.14: : Original satellite image*

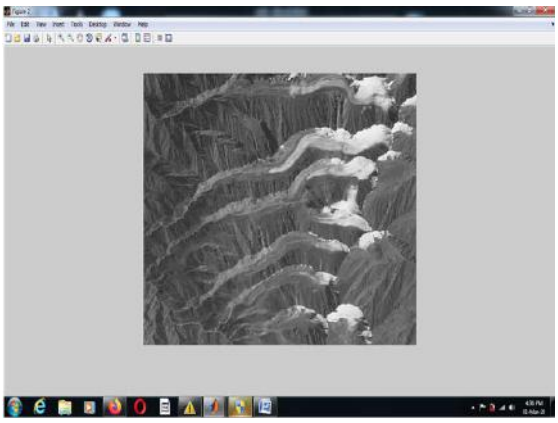

*Fig.15: RGB to gray converted image*

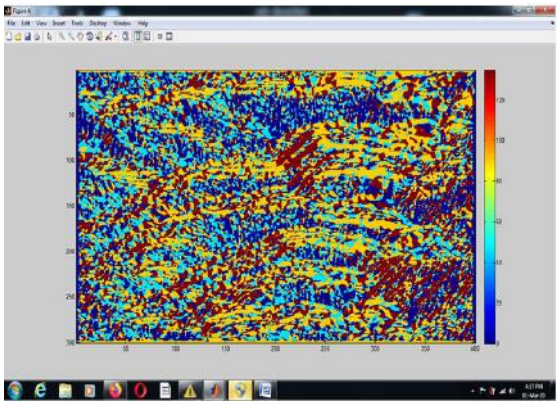

*Fig.16: Adjusting the direction to nearest 0,45,90 or 135 degrees*

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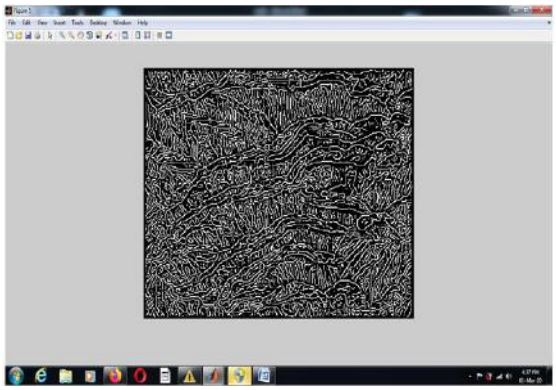

*Fig.17: Calculation of magnitude and non-maximum value suppression*

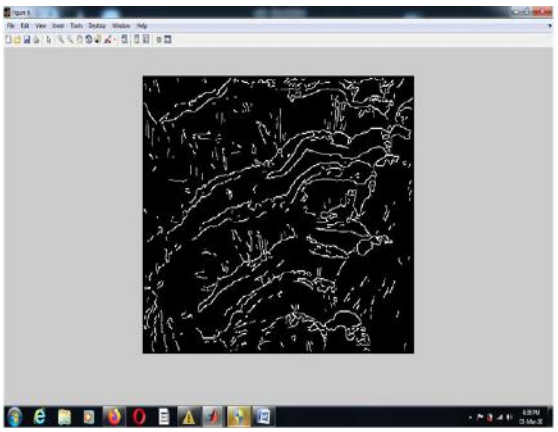

*Fig.18: Thresholding using 8-connected components*

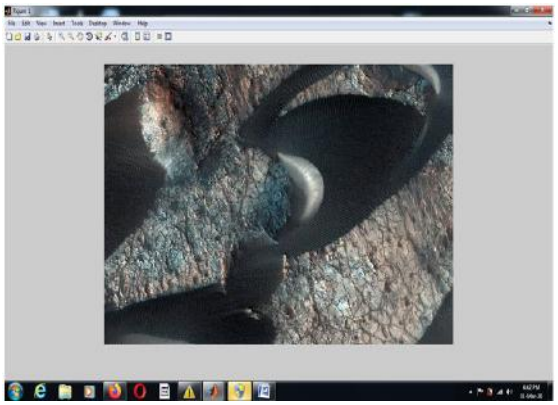

*Fig.19: Original satellite image*

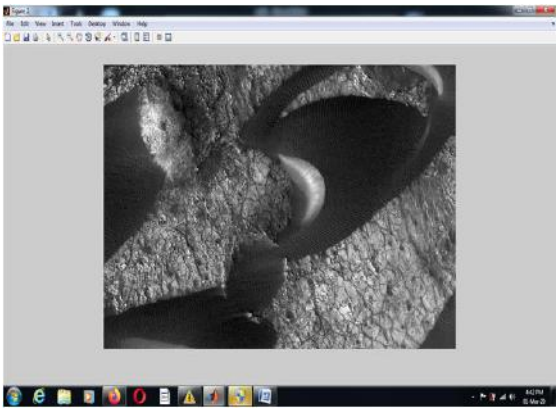

*Fig.20: RGB to gray converted image*

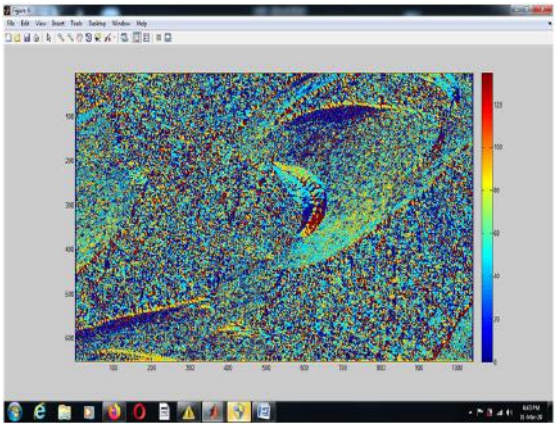

*Fig.21: Adjusting the direction to nearest 0,45,90 or 135 degrees*

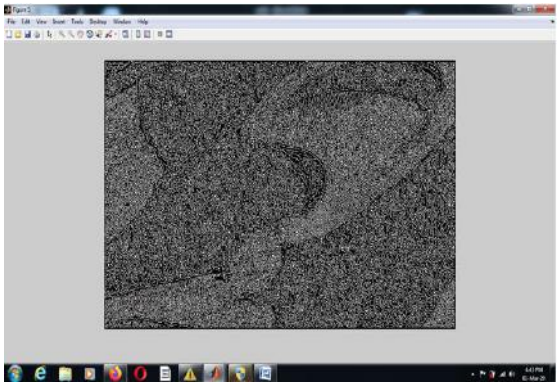

*Fig.22:Thresholding using 8-connected components*

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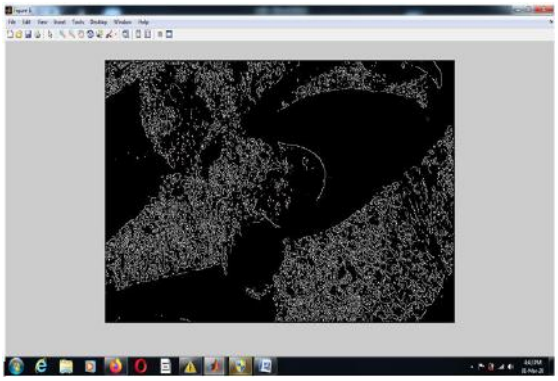

*Fig.23: Thresholding using 8-connected components*

## III. CONCLUSION

In this paper, we have seen different edge detecting techniques among them canny edge detector gives better results compared to others.

It is adaptive in nature, less sensitive to noise, resolved the problem of streaking, provides good localization and detects sharper edges as compared to others.

Canny edge detection technique is used in license plate reorganization system finds practical application in traffic management, public safety and military department.

Satellite images are not very clear and information can be easily obtained from detecting the edges by using canny edge detection algorithm which is a part of segmentation process.

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