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A Practical Ant Colony Optimization Technique basedImage Edge Detection

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Abstract: Edge detection could be a cardinal mechanism to be enforced within the image process. Edge detection recognises the points within the digital image wherever the disruptions occur within the digital image. Hymenopterous insect colony improvement is Associate in Nursing expedient for the illumination of the improvement based complication. ACO is galvanized by masticating behaviour of ants. This ransack behaviour of ants is employed for unfold the matter of expose of edges.In this paper we have a tendency to projected a restored ACO algorithmic rule for digital pictures edge chase down. We've projected a replacement changed ACO algorithmic rule for higher perception within the pictures, additionally which provides excellent performance of the improved algorithmic rule and it correlate the experimental results with antecedent normal one. The crucial factor ought to be thought-about within the ACOalgorithms are that the acquaintance of framework of revelation with post scholarship regarding the framework of previous outcomes. The implementation work shows the efficiency and parameters such as PSNR (peak Signal to Noise Ration) has been calculated.

Keywords: Acquaintance, Edges, ACO, Shortest path.

I. INTRODUCTION

Edge detection refers to the extraction of the sides in a very digital image. It's a method whose aim is to spot points in a picture wherever discontinuities or sharp changes in intensity occur. This method is crucial to understanding the content of a picture and has its applications in image analysis and machine vision. It's sometimes applied in initial stages of laptop vision applications edge is vital important feature in a picture and carries important data regarding the objects gift within the image. Extraction of edges is thought as edge detection.

Edge detection aims to localize the boundaries of objects in a picture and considerably reduces the quantity of knowledge to be processed. Edge detection and extraction is very crucial to recuperate data on the form, structure, and different very important characteristics of the image. Edge detection is conventionally performed exploitation algorithms like Sobel, Prewitt, Laplacian, Gaussian and different edge detection operators Edge detection is that the primary digital image process technique to identity sharp intensity changes and have discontinuities, as a result of numerous illumination, surface orientation, object size, background and material conditions.

Methods for Edge Detection

There are many methods for edge detection, but most of them can be grouped into two categories, search-based and zero crossing based. The search-based methods detect edges by first computing a measure of edge strength, usually a first order derivative expression such as the gradient magnitude, and then searching for local directional maxima of the gradient magnitude using a computed estimate of the local orientation of the edge, usually the gradient direction:

a. Gradient operator

Edge detection based on gradient operator. The edge is the place where image gray value is changing rapidly, so the method based on the derivation of the gradient operator is most widely used. The classical gradient operators are Sobel operator, Prewitt operator, Roberts operator.

b. Laplacian operator

Edge detection based on the optimum operator. The gradient of the image edge is the maximum value, that is, the inflection point of the gray image is the edge. From the mathematical point of view, inflection point of the second derivative of the function is 0. Detecting this point, whose second derivative is 0 is a way of edge detection, for example, Marr-Hildreth operator, Canny operator.

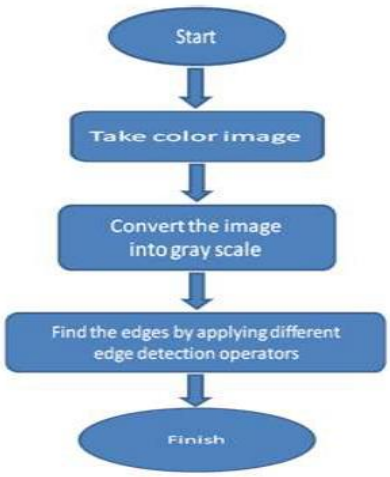

Figure 1: Flow chart for Edge Detection

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c. Multiscale edge detection
Wavelet transform is particularly suitable for signal mutation detection and edge detection. Rosenfeld suggested a combined consideration on the edge detected by multiple dimensions operator; Marr advocated applying multiple scales of different operators, and put forward some combination rules.

d. Edge detection based on ant colony optimization
(ACO) is a nature-inspired optimization algorithm motivated by the natural phenomenon that ants deposit pheromone on the ground in order to mark some favourable path

Ant Colony Optimization (ACO)
Ant colony optimization (ACO) is a nature-inspired optimization algorithm motivated by the natural phenomenon that ants deposit pheromone on the ground in order to mark some favourable path that should be followed by other members of the colony The existence of the idea of Ant Colony Optimization (ACO) is based on a biological inspiration. It is related to the concept of stigmergy is the natural adaptation that differentiates ACO from other systems. It is an indirect mode of communication in which ants being distant from each other tries to contact with each other through producing and reacting with the stimuli. In this way they deposit a\ chemical like substance called pheromone on the ground while foraging for food.

In ACO, the artificial ants following the artificial intelligence concept simulates the natural environment behaviour and applied it in the combinatorial optimization problem like Travelling Salesman Problem. Ants deposit pheromone on the ground to mark paths between a food source and their colony, which should be followed by other members of the colony. Over time, pheromone trails evaporate. The longer it takes for an ant to travel down the path and back again, the more time the pheromones have to evaporate. Shorter – and thus, favourable – paths get marched over faster and receive greater compensation for pheromone evaporation. Pheromone densities remain high on shorter paths because pheromone is laid down faster. This positive feedback mechanism eventually leads the ants to follow the shorter paths.

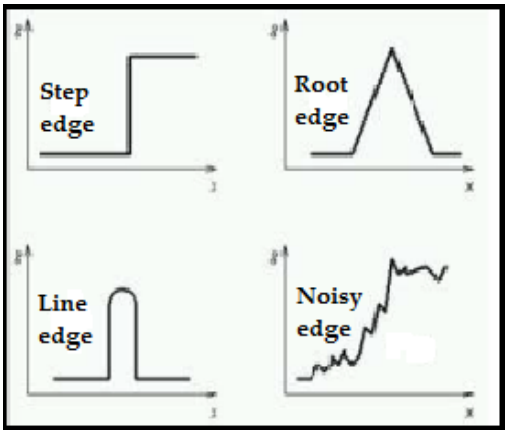

Figure 2: Different types of edges

It is this natural phenomenon that inspired the development of the ACO met heuristic. Many algorithms have been developed on ACO like Max-Min ant system and the Ant Colony System to detect an edge from digital images.

An Ant Colony Optimization algorithm (ACO) is essentially a system based on agents which simulate the natural behaviour of ants, including mechanisms of cooperation and adaptation. In many ant species, ant walking to and from a food source deposit some substance on the ground called pheromone. Different ants adopt different paths to reach the food source and deposit the pheromone based on the fact that higher concentration of pheromone is deposited on shorter paths and smaller concentration on longer paths.

Edges in Digital Image
An edge may be illustrated as a arranged set of cogonated pixels that forms a boundary between two dislocated regions An edge isthe substantial or spiritual line that fixes up the limit and this edge disunite the plane or some objects. Edges are the sudden jumps having high frequency. If we are able to discover or unmask edges in a correct and accurate way we become able to find and locate the basic properties about the images. So, by identifying the edges in the image the different features can be measured accurately.According to variation of intensity,Different types of edges are shown in fig.

Algorithm for edge detection
1. Takecolour/greyscale image
2. Smooth the image which has bi noise in images. The smoothing process is done without disturbing the edges.
3. Perform the differentiation on the images, which will manifold the quality of edges.
4. Apply the thresholding to find edge pixels
5. Localize the edges
6. Assessment with the algorithms.
7. Get the image after edge unmasking

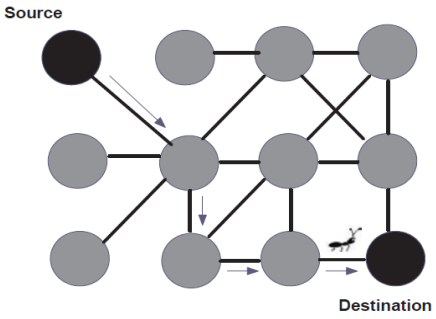

Figure 3: ACO Technique

II. LITERATURE REVIEW

Edge detection is important part of image processing for object detection. So it becomes extremely important to have a good understanding of edge detection algorithms. An edge is the real or imagined line that marks the limit and divides of plane, object or appearance from other places or things. This means that if the edges in an image

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can be identified accurately, all of the objects can be located and basic properties can be measured. This paper introduces a classification of most important and commonly used edge detection algorithms, namely Sobel, Robert, Prewitt, Laplacian of Gaussian, Canny, Ant colony Optimization [1].

Ant colony optimization (ACO) is an optimization algorithm inspired by the natural behavior of ant species that ants deposit pheromone on the ground for foraging. In this paper, ACO is introduced to tackle the image edge detection problem. The proposed ACO-based edge detection approach is able to establish a pheromone matrix that represents the edge information presented at each pixel position of the image, according to the movements of a number of ants which are dispatched to move on the image. Furthermore, the movements of these ants are driven by the local variation of the imagepsilas intensity values. Experimental results are provided to demonstrate the superior performance of the proposed approach [2].
ACO is introduced to think about the image edge detection issues where the purpose is to evolve the edge information existing in the picture, since it is critical to understand the image's content. The main mechanism of ACO is the discovery of good tours is the positive feedback done through the pheromone update by the ants. Ant colony optimization is inspired by food foraging behaviour exhibited by ant societies to find approximate solutions to the tough issues. An ACO algorithm is the combination of prior information regarding the structure of a solution with the information regarding the structure of previously obtained good solutions. Experimental results show the success of the technique in extracting edges from a digital image [3].

Edge Detection is a part of various image processing operations. Usually image is smoothen, sharpen even deblurred before performing edge detection so as to generate finer edges. This approach does works well in various cases, but there are cases where such things can damage the actual data present in image, which can be due to improper smoothening or de-blurring or excessive of both. In such cases edge detection might miss some inferior and less prominent edges which can be important part of image structure.
Thus an approach which keeps inferior edges but still distinguishes them from the other prominent edges is needed. Their approach involves a color scheme for visual ranking of edges, a marking procedure for edge probability checking, comparison threshold system and benchmarking for ranking. The approach used is influenced by behavior of ants in real world, thus will involve different ant-bots in different steps for marking of pixels and later on benchmarking them. A static benchmarking table having values ranging from 20-240 is used to allot ranks to edges as per their matching strength, thus relative color from defined color scheme. Color Scheme plays an important role in prioritization as the order and the gap in visual band of color scheme leads to clear distinction of prominent and inferior edges [4].

Edges contain important information in image and edge detection can be considered a low level process in image processing. Among different methods developed for this purpose traditional methods are simple and rather efficient. In Swarm Intelligent methods developed in last decade, ACO is more capable in this process. This paper uses traditional edge detection operators such as Sobel and Canny as input to ACO and turns overall process adaptive to application. Magnitude matrix or edge image can be used for initial pheromone and ant distribution. Image size reduction is proposed as an efficient smoothing method. A few parameters such as area and diameter of travelled path by ants are converted into rules in pheromone update process. All rules are normalized and final value is acquired by averaging [5].

Edge detection of pictures is a vital task in computer vision and image processing. Edge detection is always study focus in the field of medical image processing and analysis. It is necessary step in medical image processing. Edge detection of noise free pictures is comparatively less complicated, however in most sensible cases the photographs area unit degraded by noise. Edges in photos provide low-level cues, which could be utilized in higher level processes, like object detection, recognition, and classification, furthermore as motion detection, image matching, and trailing. Edges and textures in image are typical samples of high-frequency information. High-pass filters deduct low-frequency image information and therefore enhance high-frequency information like edges. Many approaches to image interpretation measure supported edges. This paper proposed an enhanced edge detection using Pollination based optimization (PBO) algorithm. In this, The samples of medical images (MRI) with resolution 128×128 is given as input and output as edges of image is produced. All images are gray scaled and we converted all samples to same size (128×128). In this firstly add speckle noise then filter this image by using bilateral filter to make image noise free. A bilateral filter preserves sharp edges by systematically looping through each pixel and adjusting weights to the adjacent pixels accordingly. It extends the concept of Gaussian smoothing by weighting the filter coefficients with their corresponding relative pixel intensities. Then we use PBO for edge detection. PBO based edge detection is a new technique and it perform as well in medical field also and we used MRI images in our work [6].

The need to detect edges more efficiently leads to develop newer techniques and newer algorithms. The edges get more corrupt in noisy environment. So it becomes difficult to detect edges in such cases. So an approach that could develop edges with dense edge intensity needs to be developed. A review study is conducted where many techniques have been developed for the same purpose. In my proposed work, wavelets with higher order will be given as input to ACO. Then optimization algorithm ACO will be applied. Hence the smoothness of intensity of images and the density of edges will define the effectiveness of the proposed method [7].

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In this paper a novel approach for the detection of breast cancer is used. Many imaging techniques are introduced for the breast cancer diagnosis. In this ant colony optimization (ACO) based edge detection technique is used for the diagnosing of breast cancer. This process is used to detect outlines of an object and boundaries between objects present and the background in the image. Experimental result gives the better performance of the proposed method than other techniques [8].

III. OBJECTIVES

Identifying the edges in the images is a challenging process. To mark-up the proper changes occur in intensity is also very difficult to look after. But for the recognition of the content of the images edge detection is considerable phenomenon. For this edge detection purpose the algorithm must be selected in such a way that it will produce the desired output. Which include the clear and sharp edges for better performance and also the algorithm which we apply for the edge detection filter the relevant information from the images and sustaining the essential attributes of the images. The proposed work will give a renewed algorithm for the ACO which give its best results when applied for edge detection.

The general goal is to provide an efficient Method of Edge Detection which should cover most of the edges of the input image and the parameters need to be modified. The input image need to be of greyscale image and can be of different resolution. Our objective is to identify the implemented algorithm's result on the basis of various parameters.

The objectives of this research work are:

a. To implement the Jing Tian's Image Edge Detection using Ant Colony Optimization algorithm using MATLAB on Windows 7 platform.
b. To improve the drawbacks of that algorithm and comparing it with the new improved algorithm.
c. To compare the results of both algorithms and represent those results graphically.

IV. PROPOSED METHODOLOGY

The proposed approach used is basically the alteration and conversion of the previously used ACO algorithm into a new refined and enlightened algorithm for the edge detection. New modified algorithm for ACO is introduced for accoutrement the complications of tracking down the edges in the images.

The process of grasping the observation and knowledge of the images is very crucial concept. The renewed algorithm formed is to be applied on the images to get the best results for the detection of edges. As edge detection is a fundamental and key problem in the image diagnosis.

The ACO based edge detection approach utilizes the ACO algorithm to detect the edges of an image by propagating ants to the pixels of the image. The image is considered to be a 2-D graph whose nodes are image pixels.The ants move from pixel to pixel to build the pheromone matrix, which represents the edge information of each pixel. The image's intensity value is used to control the movements of the ants. The pheromone matrix is built by iteratively moving the ants N times. Next the implementation of the present algorithm proposed by Jing Tian using MATLAB has been implemented. Looking after the drawbacks we will try to improve the algorithm in order to remove them.

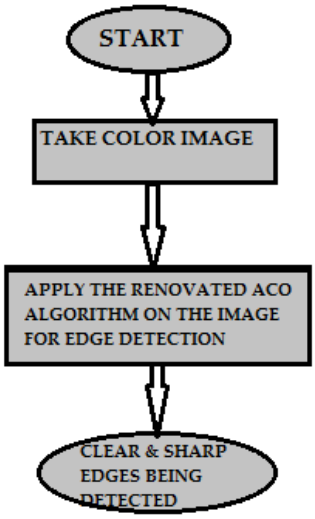

Figure 4:Proposed Work

After the completion of the above step what we have done is to implement the updated algorithm. In this step we will implement the improved algorithm using MATLAB and then comparing the present algorithm with the altered one.

At last we will do the result analysis and look after the differences in them with the help of graphs and charts.

1. Study of the Existing Algorithms
2. Identify the Different methods.
3. Identify the issue and Apply improved technique of Edge Detection using ACO.
4. Obtain Edged.
5. Performance measure of method by calculating performance parameters such as PSNR (Peak Signal to Noise Ratio).

a. Input Data

The Method and Steps has been defined and need to be implemented. The above given steps have been implemented sequentially so that we can understand the concepts already implemented, the tools which are used, the inbuilt functions of MATLAB which are available and we have used them in our algorithm for implementation.

The Edge Detection process has been implemented by using the following steps:

1. Select captured Image and taken as Input.

2.Then the image will be saved by using a particular format.

3.Calculate the different values such as Intensity Value, generated the Edges.

4.Generate the results with Improved Quality.

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V. RESULTS

The number of experiments has been implemented and the histogram has been drawn of the input images and edge output images.

Experiment:-1

Figure 5: Input Images

The Input images have been taken and edges will be improved. This image has been improved by the algorithm and shown in figure below. The different edges have been detected and can be identified directly. For accuracy measurements, the PSNR, values calculations has been measured.

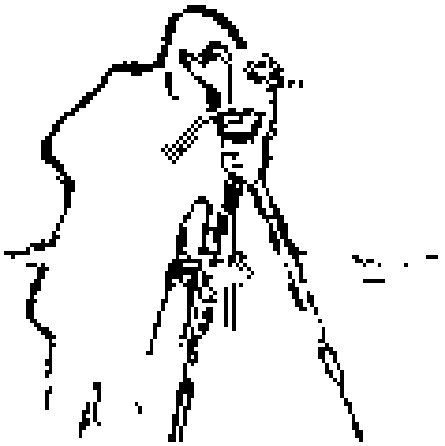


Figure 6: Output Edge Images

Experiment: 2

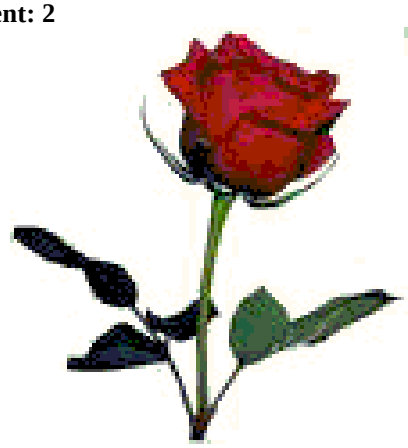
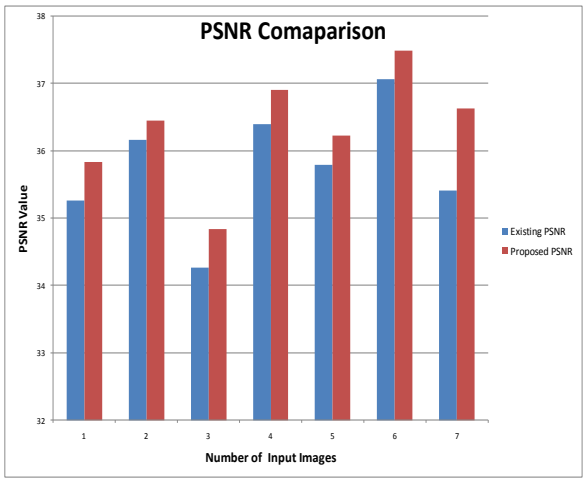


Figure 7: Input Images 2

Figure 8: Output Edge Images 2

Output: PSNR Comparison

Figures	Existing PSNR	Proposed PSNR
1	35.2629038	35.8415151
2	36.1659184	36.4560111
3	34.2684154	34.8446654
4	36.4045164	36.9115938
5	35.7960361	36.2300081
6	37.0638080	37.4925921
7	35.4127225	36.6317726



The histogram of experiments is shown as:

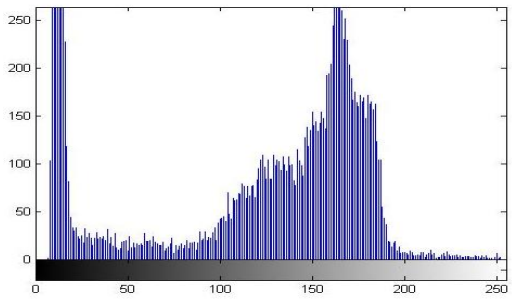


Figure 9: Input Image Histogram

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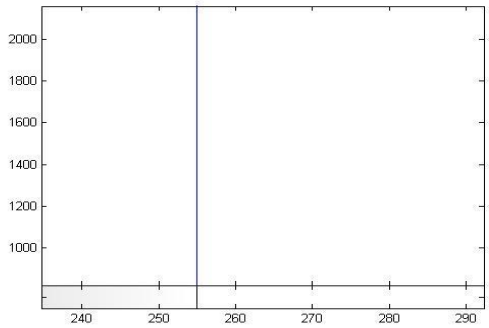

Figure 10: Edged Image Histogram

PSNR Calculation:

The Edges has been detected the and parameters has been calculated such RMSE and PSNRwhich has been explained above.

The root-mean-square deviation (RMSD) or root-mean-square error (RMSE) is a frequently used measure of the differences between values (sample and population values) predicted by a model or an estimator and the values actually observed.

The Mean Square Error (MSE) and the Peak Signal to Noise Ratio (PSNR) are the two error metrics used to compare image quality. The MSE represents the cumulative squared error between the output and the original image, whereas PSNR represents a measure of the peak error.

For Experiment, the PSNR and MSEvalues have been shown:

	Experiment-1	Experiment-2
RMSE	4.05	3.65
PSNR	36.02	36.91

VI. CONCLUSION AND FUTURE WORK

In this paper a modified ACO based image edge detection has been auspiciously cultivated. The proposed approach turnout to produce a remarkable performance as compared to the previously used algorithms for the disclosing of edges.By the use of modified ACO the perception of the images has also increased to a great extend.

In future we would try to increase the more accuracy of the edges and try to fetch the best performance. The ACO is applied in such a way that it will extract the attributes of images in a convenient way.

REFERENCES

[1] Sunanda Gupta, Charu Gupta, S.K. Chakarvarti" Image Edge Detection: A Review "International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), 2013

[1] Jing Tian, "An ant colony optimization algorithm for image edge detection", IEEE, 2008

[3] M. Davoodianidaliki, A. Abedini, M. Shankayi" ADAPTIVE EDGE DETECTION USING ADJUSTED ANT COLONY OPTIMIZATION ", International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2013

[4] NavjotKaur, Parminder Singh "An Efficient Edge Detection Approach Based On Pollination Based Optimization", Int. Journal of Engineering Research and Applications, 2013

[5] GurpreetKaur Gill and Parminder Singh Saini "A SURVEY ON ADAPTIVE EDGE DETECTION TECHNIQUES USING ANT COLONY OPTIMIZATION TECHNIQUES", International Journal of Applied Engineering and Technology, 2014

[6] VarshaPatankar" A Implementation of Ant Colony Optimization Technique for Cancer Diagnosis ", International Journal of Current Engineering and Technology, 2014.

[7] Jeetu Singh, AnkitVidyarthi "Digital Image Edge Detection using Enhanced Ant Colony Optimization Technique", International Journal of Computer Applications, 2013

[8] SivaramakrishnanRajaramanandArunChokkalingam "Chromosomal Edge Detection using Modified Bacterial Foraging Algorithm", International Journal of Bio-Science and Bio-Technology, 2014

[9] S.Venkatesan and Dr.S.SrinivasaRaoMadane" Experimental Research on Identification of Face in a Multifaceted Condition with Enhanced Genetic and ANT Colony Optimization Algorithm", International Journal of Innovation, Management and Technology, 2010

[10] Mohit Mehta Munish Rattan "AN IMPROVED ACO BASED ALGORITHM FOR IMAGE EDGE DETECTION", International general of computing and corporate research, 2012

[11] Zhengmao Ye, HabibMohamadian, and Yongmao Y" Quantitative Analysis of Feature Detection Using Adaptive Canny Edge Detector and Enhanced Ant Colony Optimization", International Journal of Modelling and Optimization, 2012

[12] Prashant Kumar Mohanty" On Edge Detection of Images Using Ant Colony Optimization and Fisher Ratio", 2012

[13] ShwetaAgarwal" A REVIEW PAPER OF EDGE DETECTION USING ANT COLONY OPTIMIZATION TECHNIQUES", International Journal of Latest Research in Science and Technology, 2012

[14] P.Thukaram, S.J.Saritha" Image Edge Detection Using Improved Ant Colony Optimization Algorithm" International Journal of Research in Computer and Communication Technology, 2013

[15] Yu Xiong "Research on an Edge Detection Algorithm of Remote Sensing Image Based on Wavelet Enhancement and Morphology", JOURNAL OF COMPUTERS, 2014

[16] Kavita1, Harpreet Singh Chawla2 and J.S. Saini3 "Parametric comparison of Ant colony optimization for edge detection problem", International Journal of Computational Engineering & Management, 2011