RESEARCH ARTICLE OPEN ACCESS

An Efficient Edge Detection Approach Based On Pollination Based Optimization

Navjot Kaur[1], Parminder Singh[2]
[1]Research Fellow, [2]Asstt. Professor
[1,2] Chandigarh Engineering College, Landran, Mohali(PB)

Abstract
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.

Keywords— Edge Detection, Medical field, MRI images, PBO, Bilateral Filter.

I. INTRODUCTION

In many computer vision systems, orientation and intensity information about edges in images are used as inputs for further processing to detect objects. Precise information about edges is vital to the success of such systems [1]. Information about edges is widely used in image segmentation, image registration, image classification and pattern recognition. Hence, detection of exact edges is a very important part of image processing algorithms [2].

From an application-level view, an edge detection algorithm is one which could be able to provide continuous contours of the object boundaries. However, the computations required to establish these continuous contours would be very time consuming and complex. From a pixel level view, the edges are the areas of an image where the pixel intensities undergo a sharp change. These areas shape the contours which represent the boundary of objects. Although many edge detection algorithms have been proposed in the literature over the past three decades to improve precision of recognized edges, they still suffer from producing broken edges [3]. A noise phenomenon is the most important obstacle to the detection of continuous edges [4].

It causes some variation of pixel intensities and accordingly reduces the performance of an edge detection algorithm in noisy images. Another important barrier which complicates the operation of edge detection is illumination phenomenon which causes the magnitude of the edges in the illuminated areas to become weak [5]. Since most edge detection algorithms utilise a thresholding technique to classify a pixel as an edge or non-edge based on its magnitude, a pixel with a weak magnitude may be recognised as non-edge and accordingly the edges become broken.

Traditional edge detection algorithms are very fast but they cannot perform well on noisy images and usually produce broken edges or noise spots. Advanced edge detection algorithms, which usually utilise soft computing techniques such as neural networks and support vector machines for edge detection, are highly problem-dependent and domain specific [12].

II. EDGE DETECTION

Edge detection may be a vital space within the field of pc Vision. Edges outline the boundaries between regions in a picture that helps with segmentation and beholding. They'll show wherever shadows fall in a picture or the other distinct modification within the intensity of a picture. Edge detection may be a basic of low level image process and sensible edges are necessary for higher level process. Edge detection refers to the method of

characteristic and locating sharp discontinuities in a picture. The discontinuities or abrupt changes in element intensity characterize boundaries of objects during a scene.

Edge Detection Techniques are classified as follows: the primary order by-product of selection in image process is that the gradient. The second order derivatives of selection in image process are typically computed exploitation Laplacian. For Sobel, a Prewitt & Roberts technique performs finding edges by thresholding the gradient for the log. By default edge perform mechanically computes the edge to use. For Sobel& Prewitt strategies, we are able to opt to discover horizontal edges, vertical edges or each. Laplacian of a Gaussian (LOG) finds edges by searching for zero crossing once filtering with a Gaussian filter. Zero crossing finds edges by searching for Zero crossing once filtering with a user-specified filter. Clever finds by searching for native maxima of the gradient. The gradient is calculated exploitation the by-product of a Gaussian filter. The strategy used 2 thresholds to discover sturdy & weak edges, and includes the weak edges within the output provided that they're connected to sturdy edges. Therefore; this technique is a lot of doubtless to discover true weak edges. Sobel edge detector technique is somewhat tough than Prewitt edge detector. Prewitt edge detector technique is slightly easier to implement computationally than the Sobel detector. However it tends to supply somewhat noisier results. Parliamentarian edge detector is one amongst the oldest & simplest edge detectors in digital image process. It's still used oftentimes in hardware implementations wherever simplicity & speed are dominant factors. This detector is employed significantly but the others. Attributable to partly to its restricted practicality. Log smoothes the image (thus reducing noise) and it computes the Laplacian that yields a double edge image. Zero crossing edge detector supported same thought because the LOG technique however the convolution, is disbursed employing a nominal filter. Clever edge detector is that the most powerful edge detector provided by performs edge [2]. The disadvantages of clever edge detector ar advanced computation, false zero-crossing and time overwhelming [12].

In the system represented in [5], they need planned a unique methodology supported mathematical logic reasoning for edge detection in digital pictures while not determinant the edge worth. The planned approach begins by segmenting the photographs into regions exploitation floating 3x3 binary matrix. an instantaneous fuzzy illation system mapped a spread of values distinct from one another within the floating matrix to notice the sting by exploitation eight planned rules.

In the system represented in [8], they need planned a brand new edge detection technique supported the BP neural network. They classified the sting patterns of binary pictures into sixteen potential varieties of visual patterns. Then once coaching the pre-defined edge patterns, the BP neural network is applied to corresponds any form of edges with its connected visual pattern.

Edge detection refers to the method of characteristic and locating sharp discontinuities in a picture. The discontinuities area unit abrupt changes in constituent intensity that characterize boundaries of objects in a very scene. Classical ways of edge detection involve convolving the image with associate degree operator (a 2-D filter), that is made to be sensitive to massive gradients within the image whereas returning values of zero in uniform regions. This can be a particularly sizable amount of edge detection operators offered, every designed to be sensitive to bound kinds of edges. Variables concerned within the choice of a footing detection operator include:

- Edge orientation: The pure mathematics of the operator determines a characteristic direction during which it's most sensitive to edges. Operators are optimized to seem for horizontal, vertical, or diagonal edges.
- Noise environment: Edge detection is troublesome in screeching pictures, since each the noise and therefore the edges contain high-frequency content. tries to cut back the noise lead to blurred and distorted edges. Operators used on screeching pictures area unit usually larger in scope, in order that they will average enough information to discount localized screeching pixels. This leads to less correct localization of the detected edges.
- Edge structure: Not all edges involve a step amendment in intensity. Effects like refraction or poor focus may end up in objects with boundaries outlined by a gradual amendment in intensity. The operator has to be chosen to be alert to such a gradual amendment in those cases. Newer wavelet-based techniques really characterize the character of the transition for every draw near order to tell apart, for instance, edges related to hair from edges related to a face.

There is a unit many ways to perform edge detection. However, the bulk of various ways is also classified into 2 categories:

(i) Gradient: The gradient methodology detects the sides by craving for the utmost and minimum within the derivative of the image.

(ii) Laplacian: The Laplacian methodology searches for zero crossings within the second by-product of the image to search out edges. a footing has the one-dimensional form of a ramp and hard the by-product of the image will highlight its location.

Clearly, the by-product shows a most placed at the centre of the sting within the original signal. This methodology of locating a footing is characteristic of the "gradient filter" family of edge detection filters and includes the Sobel methodology. A constituent location is said a footing location if the

worth of the gradient exceeds some threshold. As mentioned before, edges can have higher constituent intensity values than those encompassing it. Therefore once a threshold is about, you'll compare the gradient price to the edge price and sight a footing whenever the edge is exceeded. What is more, once the primary by-product is at a most, the second by-product is zero. As a result, another various to finding the placement of a footing is to find the zeros within the second by-product. This methodology is understood because the Laplacian and therefore the second by-product of the signal.

The purpose of selecting sharp changes in image brightness is to capture vital events and changes in properties of the planet. It is shown that below rather general assumptions for a picture formation model, discontinuities in image brightness area unit seemingly to correspond to:

- Discontinuities thorough,
- Discontinuities in surface orientation,
- Changes in material properties and
- Variations in scene illumination.

III. PROPOSED APPROACH USING PBO

It has been already explained that the Edges are significant local changes of intensity in an image. Edge is the boundary between an object and the background, and identifies the boundary between overlapping and non-over lapping objects. This means that if the edges in an image can be identified accurately, all of the objects can be located and basic properties such as area, perimeter, and shape can be measured. Our first problem is to study the edge detection by using different techniques on different type of images and need to compare the results in terms of PSNR, MSE, SSIM & EPI with the implementation of PBO. In this proposed work we use Gaussian filter, bilateral filter & trilateral filter to remove noise. Pollination based optimization (PBO) based Edge detection is a new technique and we expect the results of compression to be far better in comparison to the previous techniques.

3.1 Proposed Model

The proposed model focuses on the above four objectives which are helpful in improving the edge detection parameters and are practically implemented using MATLAB 7.11.0 environment. In this proposed work, we used Pollination based optimization algorithm to optimize the results of edge detection and to form a new technique for edge detection using PBO. The objectives of our proposed work are:

- Study of Edge Detection.
- Study of previous techniques for Edge detection.
- Pointing out the pros and cons of the previous Algorithm.
- Study of PBO based Implementation for the same purpose.
- Implementation of PBO based Edge Detection.
- Comparison of PBO Results with the previous.

3.2 Basic Block Design

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. Since analysis supported edge detection is insensitive to vary among the illumination level.

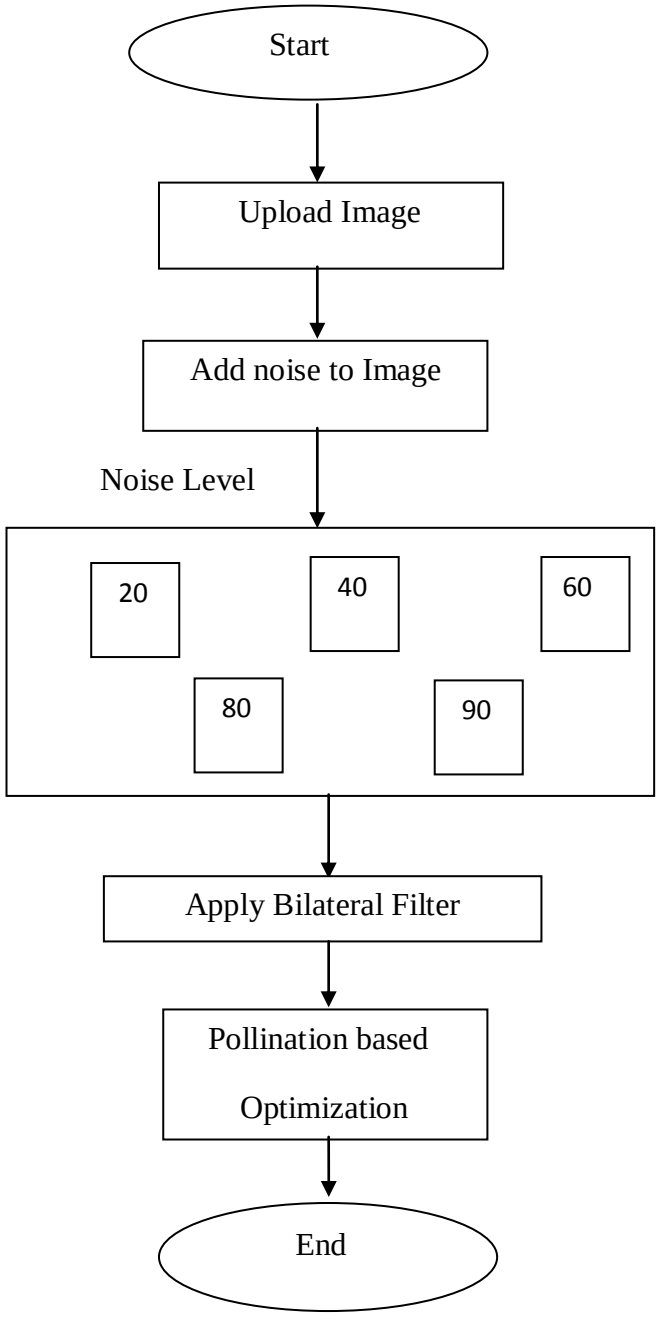

Fig 1 Basic Block Design of Proposed Work

Fig 1 shows the basic block design of the proposed model. The uploaded image is provided with the noise called speckle noise. We have also tested the code with the increased and decreased level of noise. Like we have increased the noise level by twenty, forty and sixty, eighty and ninety percent of the noise level. By default the taken noise level is ten percent. The added noisy image is provided to the Bilateral Filter. Then filtered image goes to PBO method for edge detection.

3.3 Algorithm level Design

The algorithm design is shown in Fig 2, which involves:

Step 1: Image Acquisition (MRI Images).

Step 2: Add Speckle Noise to all images.

Step 3: Remove Noise by using Bilateral Filter.

Step 4: Initialize PBO Parameters.

- a=1.2, A=0.9, D=1.2, N41.9, P=2,
- Number of Plants = 8,
- Number of weeks = 14,
- Number of seasons = 8, (number of iterations)
- Pollination weekly goal= [0.10 0.25 0.50 0.75 0.90 1.00]

Step 5: Randomly generate vectors.

- For season = 1 : number of seasons (iterations)
- For week = 1: number of weeks
- For k = 1: number of plants

Step 6: Evaluate Reproduction Vector:

$$R = \frac{(A \times D)}{(\alpha + A \times D)} + \frac{\left(\frac{a}{\alpha + A \times D}\right) \times N^P}{A^P + N^P} - C(N + D)$$

Step 7: Based on R, update number of seasons.

- Evaluate Error = Goal - R

Step 8: Based upon error update N, D, A

Step 9: Exit, if Error acceptable.

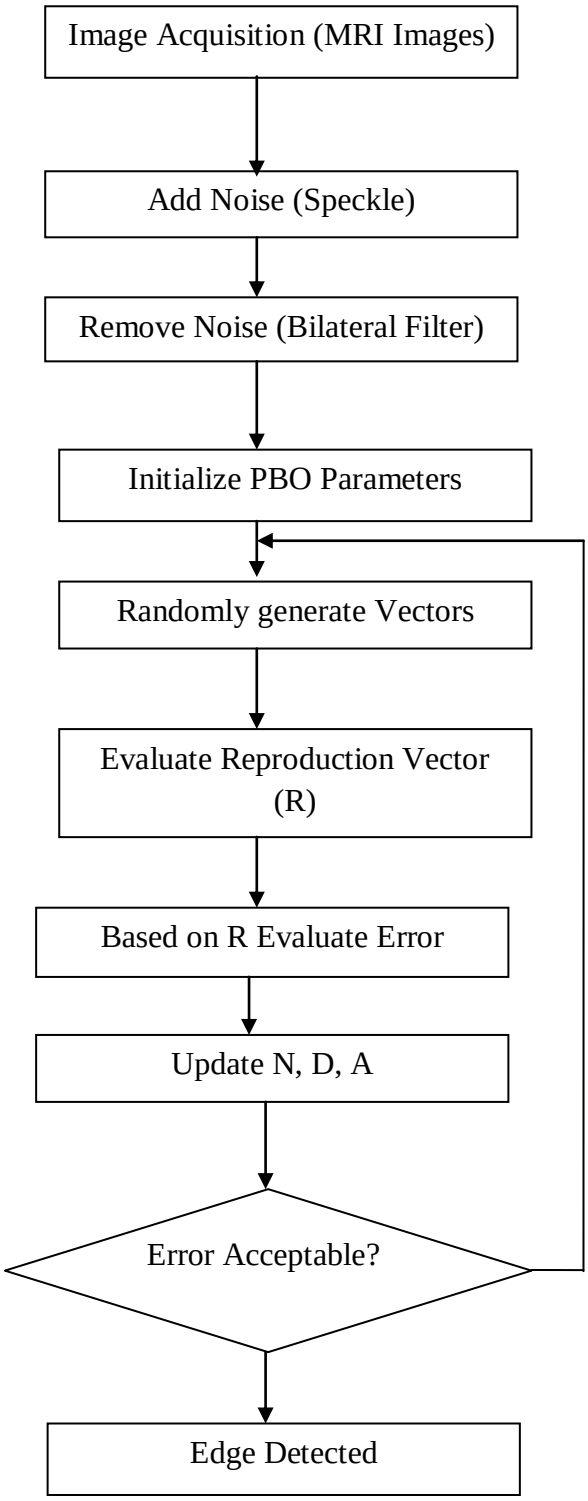

Fig 2: Proposed Algorithm level Design using PBO

IV. RESULTS

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). Results are shown as below:

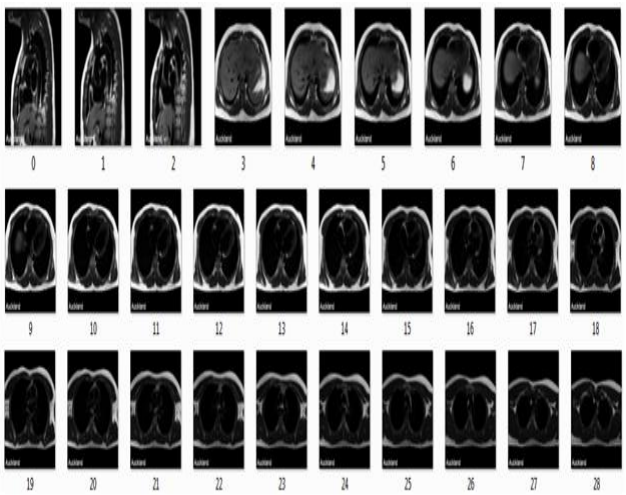

Fig 3: Sample Images

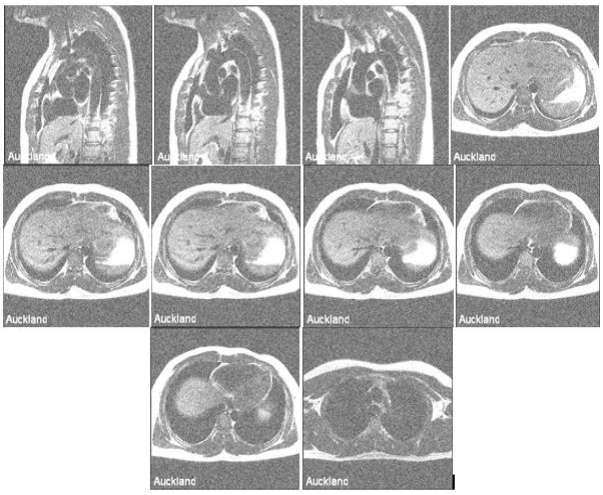

Fig 4: Images with speckle noise

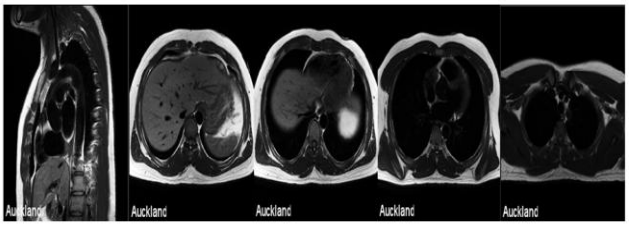

Fig 5: Testing Images

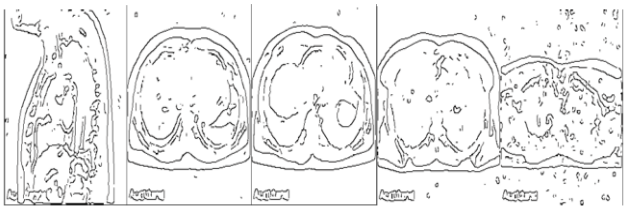

Fig 6: Edge Detection using PBO

V. CONCLUSION

The detection of the edge is one of the important part in the field of Image Processing. In this paper we proposed an efficient PBO based algorithm for images edge detection. The detection is basically done as per the natural phenomenon of PBO. In this we use Bilateral filter to remove noise. Then we use PBO that is pollination based optimization algorithm. This technique achieves better results.

REFERENCES

[1] Gupta, A., Ganguly, A. ; Bhateja, V., "A noise robust edge detector for color images using Hilbert Transform" Advance Computing Conference (IACC), 2013 IEEE 3rd International, pp. 1207 – 1212, 2013.

[2] Verma, Rohit ; Dabbagh, Mohamed-Yahia., "Binary pattern based edge detection for motion estimation in H.264/AVC" Electrical and Computer Engineering (CCECE), 2013 26th Annual IEEE Canadian Conference , pp. 1-4, 2013.

[3] Zhu, T., Xiao, X. ; He, Q. ; Diao, D., "Enhancement of SNR and Spatial Resolution in φ-OTDR System by Using Two-Dimensional Edge Detection Method" Lightwave Technology, Journal of IEEE ,Volume: 31 , Issue: 17 , pp. 2851 – 2856, 2013.

[4] Ricardo Contreras, M. Angélica Pinninghoff, Jaime Ortega., "Using Ant Colony Optimization for Edge Detection in Gray Scale Images" 5th International Work-Conference on the Interplay Between Natural and Artificial Computation, IWINAC 2013, Mallorca, Spain, June 10-14, 2013. Proceedings, Part I, pp. 323-331.

[5] Junna Shang ; Hangzhou Dianzi Univ., Hangzhou, China ; Feng Jiang, "An algorithm of edge detection based on soft morphology" Signal Processing (ICSP), 2012 IEEE 11th International Conference on signal processing, Volume:1, pp. 166-169, 2012.

[6] Rajeswari, R., and Rajesh, R., "A modified ant colony optimization based approach for image edge detection", Image Information Processing (ICIIP), 2011 International Conference on image information processing, pp. 1-6, 2011.

[7] Akansha Mehrotra, Krishna Kant Singh, M. J. Nigam, "*A Novel Algorithm for Impulse Noise Removal and Edge Detection,*" International Journal of Computer Applications (0975 – 8887) Volume 38– No.7, January 2012.

[8] wagatam Das, Arijit Biswas, Sambarta Dasgupta, and Ajith Abraham, "*Bacterial Foraging Optimization Algorithm*: Theoretical Foundations, Analysis, and Applications"

[9] M. Y. Jiang and D. F. Yuan "*A multi-grade mean morphologic edge detection*" 6th International Conference on Signal

Processing Beijing, China, pp.1079-1082, 2002.

[10] Hossein Nezamabadi-pour · Saeid Saryazdi Esmat Rashedi, *Edge detection using ant algorithm*", in proc. of Springer-Verlag, pp.623- 628, 2005.

[11] Raymond H. Chan, Chung-Wa Ho, and Mila Nikolova,"*Salt-and-pepper noise removal by median-type noise detectors and detail-preserving regularization*",*IEEE Transactions on Image Processing*, vol. 14, no. 10, pp. 1479–1485, Oct. 2005.

[12] X. Zhuang, "*Edge Feature Extraction in Digital Images with the Ant Colony System*" in proc. of the IEEE international Conference an computational intelligence for Measurement Systems and Applications, pp. 133-136,2004.

[13] Hossein Nezamabadi-pour,Saeid Saryazdi Esmat Rashedi, "*Edge detection using ant algorithms*", in proc. of Springer-Verlag, pp.623-628, 2005.

[14] Feng-ying Cui ,Li-jun Zou and Bei Song , *"Edge Feature Extraction Based on digital Image processing techniques,"* Proc. IEEE International conference Automation and logistics, Qingdao,China September 2008.

[15] M.Y.Jiang,and D.F.Yuan "*A multi-grade mean morphologic edge detection*" 6th International Conference on Signal Processing Beijing, China, pp.1079-1082, 2002.

[16] Hossein Nezamabadi-pour · Saeid Saryazdi Esmat Rashedi, *Edge detection using ant algorithm*", in proc. of Springer-Verlag, pp.623- 628, 2005.

[17] Raymond H. Chan, Chung-Wa Ho, and Mila Nikolova,"*Salt-and-pepper noise removal by median-type noise detectors and detail-preserving regularization*",*IEEE Transactions on Image Processing*, vol. 14, no. 10, pp. 1479–1485, Oct. 2005.

[18] X. Zhuang, "*Edge Feature Extraction in Digital Images with the Ant Colony System*" in proc. of the IEEE international Conference an computational intelligence for Measurement Systems and Applications, pp. 133-136,2004.