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A Optimized Analysis of Different Edge Detection methods in Image Restoration with Neuro-Fuzzy Technique

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Abstract

Image restoration is to improve the quality of the degraded image. It is used to recover an image from distortions to its original image. Image Deconvolution method is used as a linear image restoration problem where the parameters of the true image are estimated using the observed or degraded image and a known Point Spread Function (PSF). To improve quality of image Genetic algorithm is replaced by technique called BBO for the restoration of image for better quality of image . Genetic algorithm[2] is slower than Biogeography based optimization So Ant colony optimization algorithms based on the pheromone trail laying and follow behavior of real ants which use pheromones as a communication medium have been applied to many combinatorial optimization problems, ranging from quadratic assignment to protein folding or routing of vehicles .In this paper , ACO technique used to optimized the edge detection[1] in image restoration. There are various edge detection methods available to detect an edge of the image such as Sobel, Prewitt, Roberts, and Canny. The edges can be detected effectively using Ant colony Optimization method[8]. Edge provides a number of derivative (of the intensity is larger than threshold) estimators. The edge can be detected for checking whether there exists ringing effect in an input image or not. Thus ACO is used to solve image processing problem with a reference to a new automatic restoration technique based on real-coded particle ant colony is proposed in this paper. And also use Neuro-Fuzzy algorithm to enhance the previous result. ANFIS tool is used to overcome the limitation of previous work.

Keywords:- Edge detection ,Ant colony optimization, Image restoration, Neural networks, and Fuzzy

I. INTRODUCTION

Image restoration is to improve the quality of the degraded image. It is used to recover an image from distortions to its original image. It is an objective process which removes the effects of sensing environment. Its need in Medical imaging technology which is an important component of large number of applications such as research and treatment. Medical images like X-Ray, CT, MRI have minute information about heart, brain and nerves. These images need to be accurate and distortion free and to achieve the best possible diagnosis it is important that medical images should be sharp, clear, and free of noise and artifacts. Noise reduction plays an important role in medical imaging. Many of the techniques developed for medical imaging also have scientific and industrial applications.

There are various methods of image denoising[4] and various techniques such as filters, wavelets and thresholding based on wavelets have been used for noise removal.. The proposed research uses both statistical functions for calculating the output pixels of training patterns to provide promising results in terms of PSNR and MSE. The evaluation also includes both mean and median functions. The evaluation was based on the PSNR, MSE values. The proposed approach i.e, improved technique for medical image de-noising using SVM and LDA exhibits outcome of noise reduction and image quality improvements, with different noise levels, which qualify it to be suitable for image processing and de-noising.. In this paper, restoration occur on the basis for the made of a newfield: Ant Colony Optimization (ACO) is way to design or to take decision as efficient as possible. The antcolony optimization algorithm (ACO) is a technique to solve different problems which can be minimize to finding good path through graph[11].

II. ANT COLONY OPTIMIZATION FOR EDGE DETECTION

Current applications of ACO algorithms fall into the two important problem classes of static and dynamic combinatorial optimization problems.[6].The Static problems are those whose topology and cost do not change while the problems are being solved. The original image is degraded or blurred using degradation model to produce the blurred image. The blurred image should be an input to the BID[7] algorithm. The result of this algorithm produces the deblurred image which can be compared with our original image. Deblurred image has ringing effect on its edges which can be removed with help of ACO. ACO is nature inspired methodology based on the behavior of real ants[3] and their communication scheme by using pheromone trail .During the Deconvolution process, high frequency drop-off at the edges of images can occur due to the debluring functions. This high frequency drop-off can create an effect called boundary related ringing in deblured images. For avoiding this ringing effect at the edges of the image, we have to detect the edges of an image.

There are various edge detection methods available to detect an edge of the image such as Sobel, Prewitt, Roberts, and Canny. The edges can be detected effectively using Ant colony Optimization method[10]. Edge provides a number of derivative (of the intensity is larger than threshold) estimators. The edge can be detected for checking whether there exists ringing effect in an input image or not. The optimal locality, the maximum suppression of false response, were performed by Canny, who also proposed an edge detector taking into account all three of these measurements. The Canny edge detector was used in the food industry for boundary extraction of food products

III. Canny Edge Detection

The Canny edge detector is an edge detection operator to detect a wide range of edges in images. The algorithm runs in 5 separate steps: 1. Smoothing: Blurring of the image[5] to remove noise. 2. Finding gradients: The edges should be marked where the gradients of the image has large magnitudes. 3. Non-maximum suppression: Only local maxima should be marked as edges. 4. Double Thresholding: Potential edges are determined by Thresholding. 5. Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

Matlab coding for canny edge detection

```
I=I mread('coins.png');
Imshow(I)
BW1= edge(I,'Sobel');
BW2 = edge(I,'canny');
figure;
imshowpair(BW1,BW2,'montage')
title('Sobel Filter    Canny Filter');
```

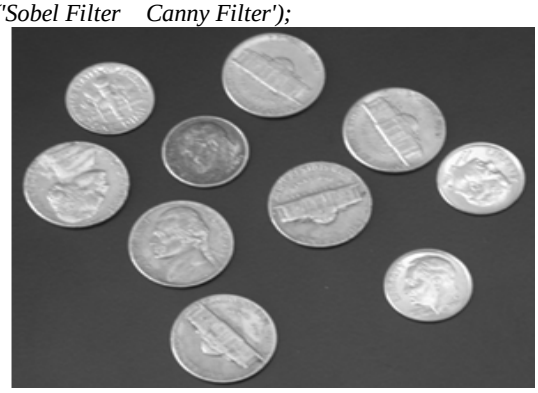

Fig 1. Coin Png Image

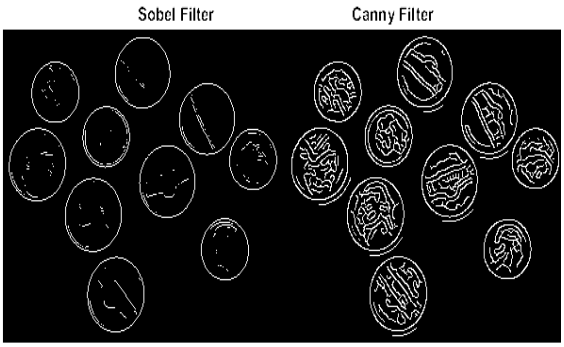

Fig. 2: .Resulted Canny and Sobe

IV.Comparison of different edge detection algorithm optimized with ACO technique.

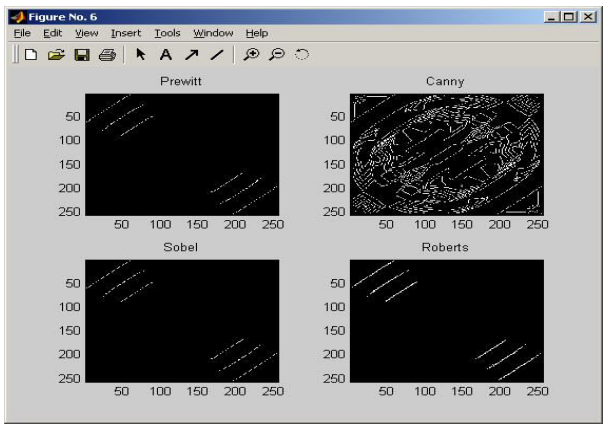

Fig 3. Results of Edge Detection

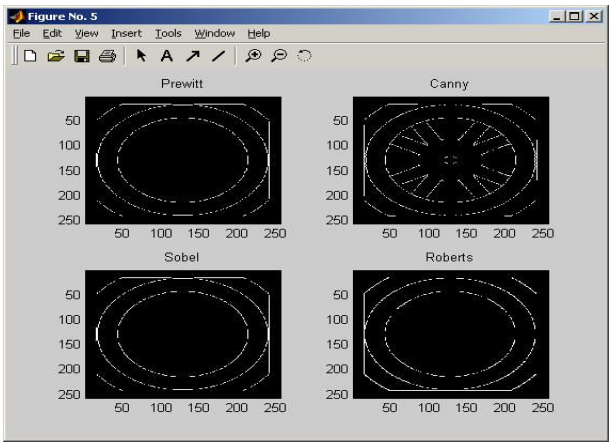

Fig 4. Ringing Effect in Edge Detection

VI. METHODOLOGY

Steps for Image Restorations:-

I. **Step 1**: Read an X-Ray figure f(y, x) known as input figure.
II. **Step 2**: Degrade the input image with a blur function to get a blurred image g(y,x) known as degraded image.
III. **Step 3**: The restore the desorted image with Blind Image De-convolution technique to obtain a restored image.
IV. **Step 4**: The resultant image of step 3 has ringing effect at its edges which reduces the quality of the image and makes the image unclear.
V. **Step 5**: To remove this ringing effect at the edges, apply ACO on the restored image for edge detection.
VI. **Step 6**: Apply edge taper function to remove ringing effects at the edges detected using ACO.
VII. **Step 7**: Finally, we get a restored image f'(x, y).

VII. NEURAL FUZZY

Neural networks give effective results for solving multiple class classification problems [9]. Notes that neural network facilitate gate recognition because of their highly flexible and non linear modeling ability. Neural network has three types of layer: input layer; hidden layers and output layer.

The hidden layer does intermediate computation before directing the input to output layer. Thus back propagation can also be taken as a generalization of delta rule. And when this back propagation network is cycled, an input pattern is propagated forward to the output units through the intervening input to hidden and hidden to output weights. A neural network has been widely used in image and signal processing

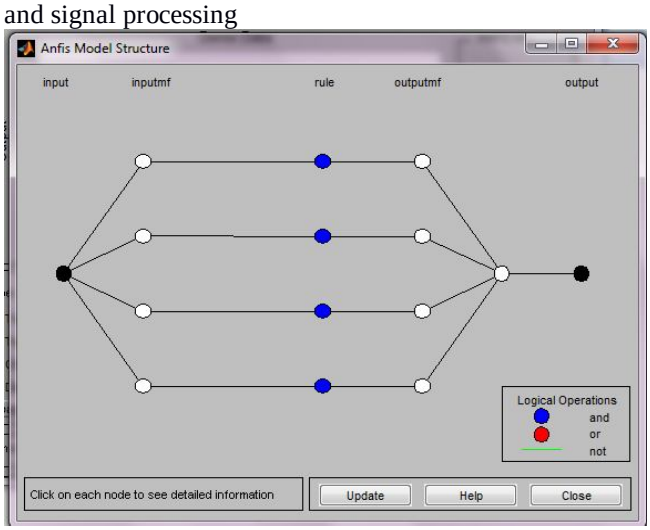

Fig 5. Neural Network in ANFIS Tool

Here combine both Neural Network and Fuzzy algorithm to enhance the result as compare to previous work. At last here we use ANFIS tool i.e. combination of NN and Fuzzy.

VIII. RESULT AND DISCUSSION

Digital figure processing plays an important role in the analysis and interpretation of remotely sensed data. Image restorations technique help in improving the visibility of any portion or feature of the image suppressing the information in other portions or features.

An interface has been designed :-

Fig 6. GUI with Edge image

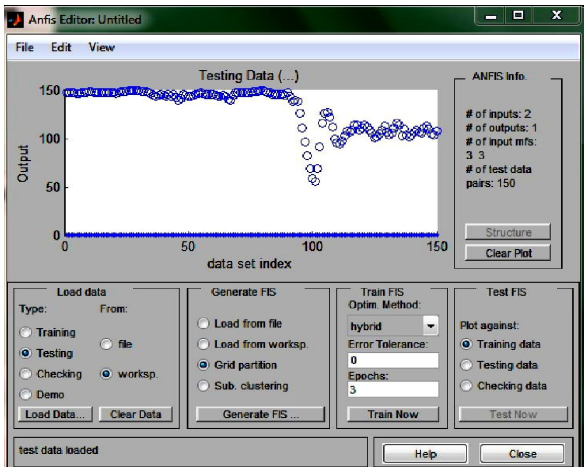

Fig 7. Testing data in ANFIS

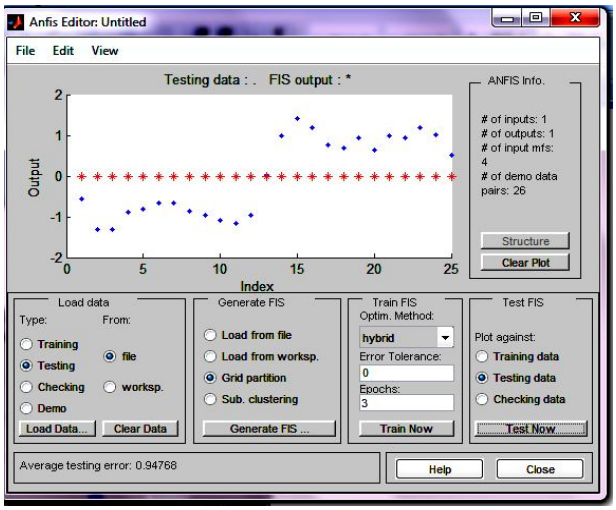

Fig 8. Testing data in ANFIS editor with FIS output

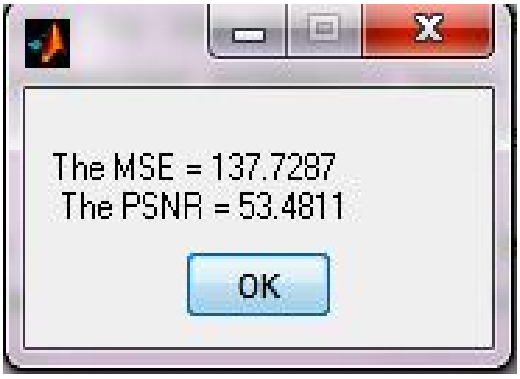

Fig 9. Performance metrics MSE and PSNR values

The above figure shows the result of image restoration with ACO and Neuro Fuzzy algorithms[9] i.e. by using ANFIS tool to enhance the previous work. By using these algorithm we have MSE value is 137.7287 and PSNR is equal to 53.4811

X. CONCLUSION

Image restoration processes consist of a collection of techniques. In this work, ACO technique is applied for the restoration of image. Biogeography based optimization technique play an important role in enhancing the quality and contrast of images. We have presented a method for

blind image Deconvolution using Ant Colony Optimization. The method differs from most other existing methods by using ACO for detecting the edges and ringing effect at the edges of the image. Good estimates of both the image and the blurring operator are reached by initially considering the main image edges. In this paper, an ACO-based image edge detection approach has been successfully developed. The proposed approach yields superior subjective performance to that of the existing edge detection algorithm such as Sobel, Prewitt, Roberts, and Canny. It yield a good quality of restored image.

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