International Journal of
Emerging Research in Management &Technology
ISSN: 2278-9359 (Volume-6, Issue-7)

Research Article

July 2017

Effective Non-Linear Prefiltering Method for Coloured Edge Detection of Noisy Images

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Abstract-

This paper addresses a method to obtain color edge detection for images corrupted with Gaussian noise and impulse noise, to correctly reproduce distinct, continuous edges based on non-linear prefiltering followed by block-by-block rotations to locate the edges in all orientations. In this work our major goal is to eliminate the noise from noisy image as edges are the most important detailing areas in an image and addition of noise corrupt these edges which result in lack of clarity. In our proposed work we are proposing a efficient hybrid algorithm to preserve the edges of image based upon Canny operator. Our proposed scheme is based on rotation, median filtering and performing morphological thinning. This scheme is evaluated on basis of FOM(Figure Of Merit) parameter and our result are efficient than previous technique. This paper is divided into some sections.

Keywords-Gaussian noise; Non-Linear Prefiltering; Rotations ; Morphological thinning.

I. INTRODUCTION

Very regularly colored images are corrupted by numerous types of noise, delivered by malfunctioning or broken sensors in the photograph formation process, poor lights situations and ageing of the storage cloth, digital instabilities of the signal, transmission errors in noisy channels and atmospheric in addition to electromagnetic interferences. As a result, images are often corrupted by using a combination of various noises like Gaussian noise, Impulse noise, Gamma noise, Periodic noise.. etc. The presence of noise in an image blurs the image content, masks the image features, degrades the image quality and gives undesirable appearances to an image. Basically, Edge detection algorithm is designed for detecting and highlighting the discontinuities in the noisy and corrupted images.

Edge detection plays a very crucial position in the attention of a complete image understanding system. It's well known, however, that the era of an correct edge map turns into a completely crucial difficulty while the images are corrupted through noise. In this respect, noises having Gaussian-like distribution are very regularly encountered throughout image acquisition.For detecting the edge pixels form the noise corrupted images a two step process is been followed.In the first step the noisy image is restored near the original image on the basis of Peak to signal ratio (PSNR), and in the next step a suitable edge detector is applied on the restored image. In literature, numerous strategies for image denoising have been presented. The filters like median,average,max,min etc used in these techniques reduce noise at the cost of smoothing the image and relocating the pixels of edges. One of the extensively used denoising techniques is a nonlinear filtering technique that's famous and effective techniques applied over corrupted noisy gray scale or colour snap shots to acquire noise unfastened image. A color image can have vector of three values for each pixel unlike in grey photographs wherein a single value representing the depth of pixel. Different algorithms have been proposed for edge detection of colored images. Mostly the researches compare the results of the Sobel edge detector with the results of Canny edge detector. In trendy, to extract edges from the photographs either gradient based strategies or vector primarily based strategies are used. The method proposed obtains the better results as with low (FOM) Figure Of Merit, and locating the dominant pixels.

The work of edge detection is when performed in rotations, the image is usually represented in a matrix form and the rotations of images are performed in 2 different ways. One is to rotate on an entire image and another on blocks of image. This manner of rotating the image matrix guarantees the vanation of pixels from neighboring data that is, the intensity values of an image thereby sharp variations in addition to minute transitions can be captured efficaciously.

II. PROPOSED WORK

To detect the edge pixels from corrupted images it mainly requires some filtration/enhancements steps.

The first step is to filter noise from an image using some acceptable noise removing technique. Next step to consider is the image enhancement and in final step we detect edges using some acceptable edge detection operators. In literature various methods for removing noise from image has been presented. Some of the methods use filters such as average filter, maximum filter, median filter, alpha trimmed filter and Gaussian filter for image de-noiseing.

The filters reduce noise at cost of smoothing the image and relocating the edges pixels. The non-filtering technique is very efficent to reduce noise from corrupted image and also it maintain fine details of an image such as its edges and feature and objects. The commonly used edge detector operators are sobel operator, rotation operator, robotus operator and prewitt operator. In our work we proposed usage of rotation operation for detecting edges on 3*3 window out of all methods we are using Canny operator which is modern and standard.

Canny Edge Detection Algorithm

The improved canny operator for edge detection is proposed in paper no.6 .The first and most obvious is it decrease the noise rate and enhance the edge detection based on this criteria. The Canny edge detection first smoothes the image to illuminate noise, than it finds the image gradient to highlight the regions with spatial derivative.

The proposed method use an original color image as an input and uses a combination of block by block operations, non-linear median post filtering and morphological thinning operations.

This method reads the input image and divide in 3 channels of RGB. Firstly rotation on block by 3*3 window is done to find edge pixels and then post filtering is done to reduce noisy pixels. The proposed method for detecting edges in a color image by rotation and non-linear median post filtering uses 2 steps:

1. Apply rotation on 3*3 window size to locate dominant pixels.
2. Apply non linear median post filtering to reduce isolated and then use morphological thinning operations.
   Input of this algorithm is a colored image and output is colored edge image.

Algorithm

1. Read the input image.
2. Divide the image into RGB channel.
3. Locate the dominant pixel in each of individual color channel using step 1 below.
4. Combine all dominant pixels.
5. Enhance the image using median filtering.
6. Perform edge linking, smoothing and extraction using step 3 below.
7. Perform morphological thinning operation to get final color edge image.

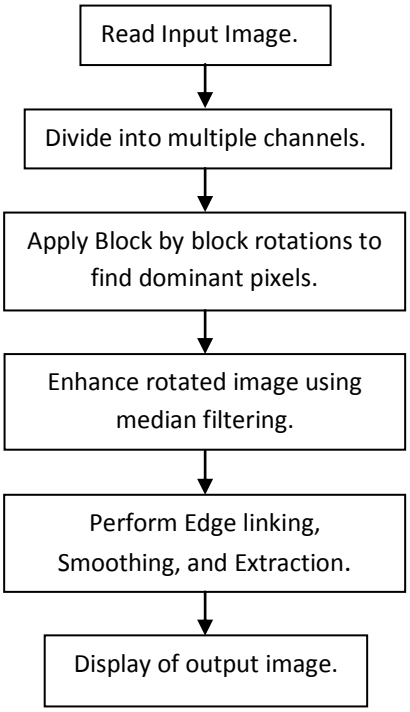


Fig 1. Block diagram of proposed method.

STEP-1: Locate dominant pixels. To locate dominant pixels, the operations performed is rotation on a block of 3*3 window signs. Let IB an input image with m*m dimensions while performing rotation we perform the steps of padding at the row above the first row. The row below last row before first column and after last column.After padding the size of image change to (m+a)*(m+a) where a is constant depends on window size.In this step following is the procedure adopted to rotate image.

a.) Let IB an original image.
b.) Rotate 3*3 block of I with 45□ □ □in clockwise and name it I1.
c.) Rotate 3*3 block of I with 45□ □in anticlockwise and name it I3.
d.) Subtract I1 from I and name it I2.
e.) Subtract I3 from I and name it I4.
f.) Add I2 and I4 to get dominant pixels named as I5.
   Similarly in this work we perform rotations at 90□ □and 135□ □ □to obtain dominant pixel as I10 and I15.
g.) Combine I5+I10+I15 to get final edge pixels I16.

STEP 2: Thresholding

In this step the linking and smoothing of edges is performed for which a new method is proposed with following steps.

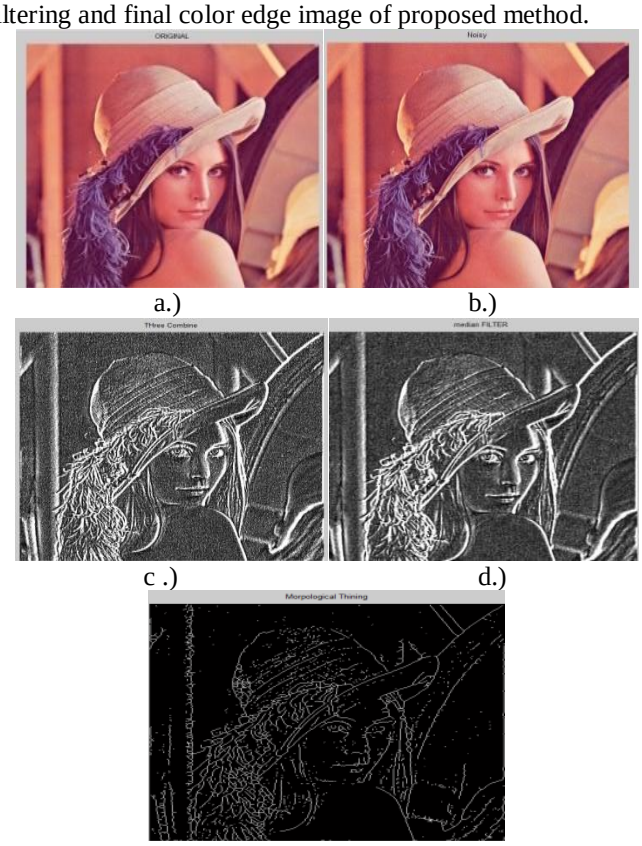
a.) Receive image.
b.) Copy image and add padding.
c.) Instances count for middle pixels. If Instances count is less than two then ignore this pixel and consider it as background pixel. Hence, merge this pixel with the background pixel. Else save this as a edge pixel.
d.) Finally perform morphological thinning and represent the standard output image.

III. RESULTS AND DISCUSSION

In this section, we present and discuss the objective as well as subjective results obtained from the new hybrid approach of proposed method. The subjective results the edge image quality is observed manually by human observation while the objective results are obtained by calculating the (FOM) Figure of Merit for edge image to show efficiency of proposed method in location of edge pixels.

A. Subjective Assessment-

Fig. 2 shows the Lena image corrupted with Gaussian noise and edges image obtained of combination of RGB, edge image obtained after median filtering and final color edge image of proposed method.



a.) b.) c .) d.) e.)

Fig 2.a.)Lena image b.) Lena image corrupted with Gaussian noise c.) The corresponding edge images obtained after color edge detection rotations d.) Image with median filter e.) Final color edge image for proposed method.

B. Objective Assessment-

The FOM is a performance measure used to check the extent of area details maintained with the aid of applying the proposed technique with a purpose to hit upon the threshold pixels from a noisy image. The Figure Of Merit(FOM) is given by Eqn(1).

$$FOM = 1 / (\max\{N, Nideal\} + d_i \lambda) \quad (1)$$

Here N and Nideal are the numbers of detected edge pixels in the prefiltered image and the original image respectively, d_i is the Euclidean distance between ith detected edge pixel from the prefiltered image and the nearest original edge pixel, and λ is a constant value.Table-I shows the calculations of FOM values for set of sample five images corrupted by Gaussian noise.The proposed scheme shows the better results in most of the cases.Fig.3 shows the calculated FOM values in graph notation.

TABLE – I FOM VALUES FOR IMAGES CORRUPTED WITH GAUSSIAN NOISE.

IMAGE	FOM value for previous method	FOM value for proposed method
Lena	0.8163	0.8432
Baboon	0.7983	0.9009
Pepper	0.8092	0.8939

IV. CONCLUSION AND FUTURE WORK

In this work we performed a 3 step image enhancement based upon block rotations to find out dominant pixels which are very important to perform operation. The median filtering along with padding and operation of morphological thinning based upon Canny operation enhance the image details in terms of noise and edge detection. So our proposed scheme show better results for various images and our scheme reduces the complexity by using the concept of thresholding. In future the authors may work upon further refinement of image by performimg modified median filtering which may result in further image enhancement.

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