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A Novel Adaptive Denoising Method for Removal of Impulse Noise in Images using Principal Component Analysis

[1]Vijimol VV
[1]*PG Student, College of Engineering Karunagapally*

Abstract: *Images are often corrupted by impulse noise in the procedures of image acquisition and transmission. Here,an efficient denoising scheme and its structure for the removal of random valued impulse noise in images.To achieve the goal at low cost,a low complexity architecture is proposed.I employ a PCA based technique to estimate the noisy pixels, and an edge preserving filter to reconstruct the intensity values of noisy pixels. Furthermore, an adaptive technology is used to enhance the effects of removal of impulse noise. PCA is used to estimate the noise and an edge preserving filter is used to enhance the image. Extensive experimental results demonstrate that the proposed technique can obtain better performance in terms of both quantitative evaluation and visual quality than the previous lower complexity methods.*
Keywords: *PCA, Edge preserving filter, image denoising, impulse detector*

I. Introduction

Image processing is widely used in fields, such as medical imaging,remote sensing,face recognition etc.This method consist of two major components,(a) noise estimation using principal component analysis (b) remove the estimated noise edge preserving filter.PCA finds an estimate of impulse noise present in the images .PCA is one of a family of technique for taking high dimensional data to represent that data in lower dimensional form, without losing too much information. Finally edge preserving filter removes the estimated noise in the images and enhances the images.

II. PCA

Principal Component analysis is one of the simplest methods for dimensionality reduction.PCA is used to compress the images by reducing the number of dimensions,without much loss of information.PCA is an important tool for analysis of images in image processing.The input image is undergoes PCA analysis it will give an estimate of impulse noise present in the images.The estimate shows the noise present in the images.When the estimated value is high, the quality of the image will be less.

III. Edge Preserving Filter

To find the noisy pixels, herean edge preserving filter used. The edge preserving filter finds the noisy pixels in the images and it replaces the noisy pixel value with constructed value.For calculating the constructed value,a 3 × 3 mask is used.The edge filter calculates the directional differences of the chosen directions and locates the smallest one(D_{min}).Edge preserving filter calculates the smallest directional difference and replace thatpixel with constructed values.

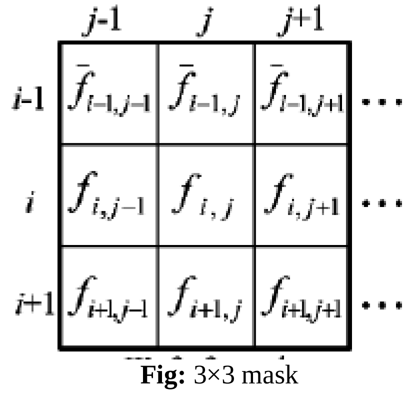

Fig: 3×3 mask

The 3×3 mask used for calculating the directional differences. The $f_{i,j}$ denotes the centre pixel in the mask. The mask is used for finding the noisy pixels in the image. If the pixel is noisy, then replace that noisy pixel with reconstructed value.

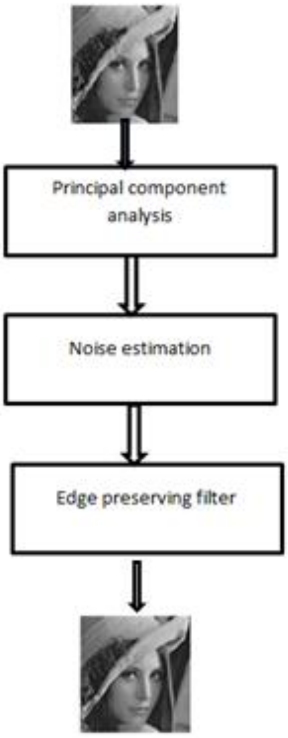

Fig: Working method of proposed system

The block diagram shows the core working of the proposed method. The noisy image is the input with random valued impulse noise. Then this image undergoes principal component analysis and calculates the estimate of noise present in the image. Then edge preserving image filter used to replace the noisy pixels in the image. Finally, the image will be enhanced.

$$
\begin{aligned}
D_1 &= |d-h| + |a-e| \\
D_2 &= |a-g| + |b-h| \\
D_3 &= |b-g| \times 2 \\
D_4 &= |b-f| + |c-g| \qquad \text{(b)} \\
D_5 &= |c-d| + |e-f| \\
D_6 &= |d-e| \times 2 \\
D_7 &= |a-h| \times 2 \\
D_8 &= |c-f| \times 2
\end{aligned}
$$

These eight equations (b) are used to find the directional differences.

$$\hat{f}_{i,j} = \begin{cases} (a+d+e+h)/4, & \text{if } D_{min} = D_1 \\ (a+b+g+h)/4, & \text{if } D_{min} = D_2 \\ (b+g)/2, & \text{if } D_{min} = D_3 \\ (b+c+f+g)/4, & \text{if } D_{min} = D_4 \\ (c+d+e+f)/4, & \text{if } D_{min} = D_5 \\ (d+e)/2, & \text{if } D_{min} = D_6 \\ (a+h)/2, & \text{if } D_{min} = D_7 \\ (c+f)/2, & \text{if } D_{min} = D_8 \end{cases}$$

These are the equations which are used for calculating the edge differences and this helps to find out the smallest edge difference. The pixel with smallest edge difference should be replaced from the image. The noisy pixel is replaced from the image with reconstructed value.

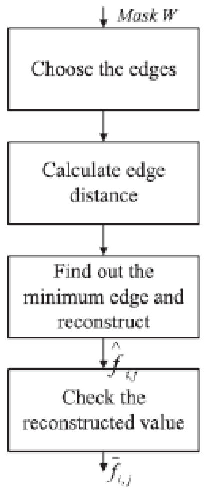

Fig: Data flow of edge preserving filter

The block diagram shows the working principle which is used for calculating the reconstructed value. The reconstructed value can be calculated using 8 directional differences. The orientations of directional differences are shown in the diagram.

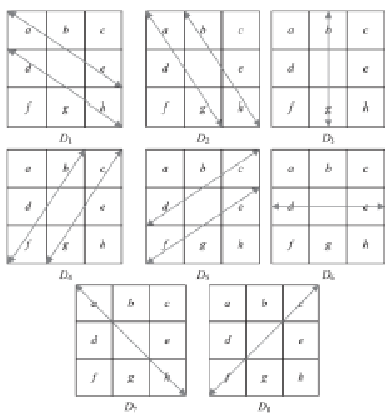

Fig: Eight directional differences of proposed method

IV. Conclusion

The proposed method for efficient removal of random valued impulse noise is proposed in this paper. The approach uses the pca method to detect the noisy pixel and employs an effective design to locate the edge. The comparison with the several methods shows that the accuracy of the proposed approach is the highest in most cases. Among the methods with similar accuracy, proposed method is always more than 15 times faster. And this method also applied in the case of Gaussian noise or any other type noises. This method can be applied to colour image processing. It can be also be utilized in the field of data pre-processing, data compression, data reconstruction.

Reference

[1]. [1] Chih-Yuan Lien, Chien-Chuan Huang, Pei-Yin Chen and Yi-Fan Lin,"AnE_cientDenoising Architecture for Removal of Impulse Noise in Images"IEEETrans.oncomputers,vol 62,NO 4,April 2013

[2]. W.K. Pratt, Digital Image Processing. Wiley-Interscience, 1991.

[3].] H. Hwang and R.A. Haddad, Adaptive Median Filters: New Algo- rithms and Results, Image Processing, vol. 4, no. 4, pp. 499-502, Apr. 1995.

[4]. S. Zhang and M.A. Karim, A New Impulse Detector for Switching Me- dian Filter, IEEE Signal Processing Letters, vol. 9, no. 11, pp. 360-363, Nov. 2002.

[5]. R.H. Chan, C.W. Ho, and M. Nikolova, Salt-and-Pepper Noise Removal by Median-Type Noise Detectors and Detail-Preserving Regularization, IEEE Trans. Image Processing, vol. 14, no. 10, pp. 1479-1485, Oct. 2005.

[6]. P.E. Ng and K.K. Ma, A Switching Median Filter with Boundary Dis- criminative Noise Detection for Extremely Corrupted Images, IEEE