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Research Article

Strategical Report on Removal of Blurring in an Original Image Using Non Linear Median Filter Technique

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Abstract: In real world application, the original signal, image, motion pictures or any another transform the removing of blur is a still challenging issue for the researchers. There have been several published algorithm, techniques and new methodologies. But each approach has its own assumptions, advantages and limitations. This study explores a technique of how image enhancement and denoising are useful in motion recording and storing for various applications such as digital still camera, video mail camera, video conferencing camera, surveillance camera, web camera, wireless camera, toy camera and digital video recorder.

Keywords: Gaussian noise, impulse noise, MATLAB software, spatial linear and non linear filter

INTRODUCTION

In daily life, digital images play a major role in satellite television, television broadcasting and computer tomography as well as in areas of research and technology such as geographical information systems and astronomy. The information is collected by image sensors are generally contaminated by noise. Imperfect instruments problems with data acquisition process and interfering natural phenomena can all degrade the data of interest. Furthermore, noise can be introduced by transmission of errors and compression. Thus the noise suppression is absolutely necessary and the first step to be taken before the image data get analyzed. So it is necessary to apply an efficient filtering and enhancement technique to compensate for such data corruption.

The removing of noise from the original image is still remains a challenge for researchers (Katkovnik *et al*., 2010). This study describes different methodologies for filtering of noise to which algorithm should be most suitable to get the original image in an enhanced manner to view by a person easily.

Noises modeling in images are greatly affected by capturing instruments, data transmission media, image quantization and discrete sources of radiation. Different algorithm is used depending upon the noise model. The scope of this study is to focus on noise removal techniques for natural images.

METHODOLOGY

Classification of image enhancement: Image enhancement fall into two categories namely spatial domain methods and frequency domain methods. Here I have used only the concept of spatial domain method to analyze the natural images than frequency domain methods. Because, frequency domain method is based on the discrete Fourier transform of an image.

Spatial Domain approach is based on the direct manipulation of pixels in an image and is denoted by Eq. (1):

$$S_{x,y} = T[\, f(x, y)] \tag{1}$$

where,
$f(x, y)$ = Input image
$S_{x,y}$ = Processed output image
T = Transform

Histogram is the only way to analyze the image distribution of an image or any function of either spatial domain or frequency domain. Histogram matching and equalization is the only way to adjust the color and contrast adjustment of the image as shown in Fig. 1 (Bioucas-Dias and Igueiredo, 2010; Zho *et al*., 2013).

Classification of denoising algorithm: This can be divided into two types' namely spatial filtering methods and transform domain filtering methods.

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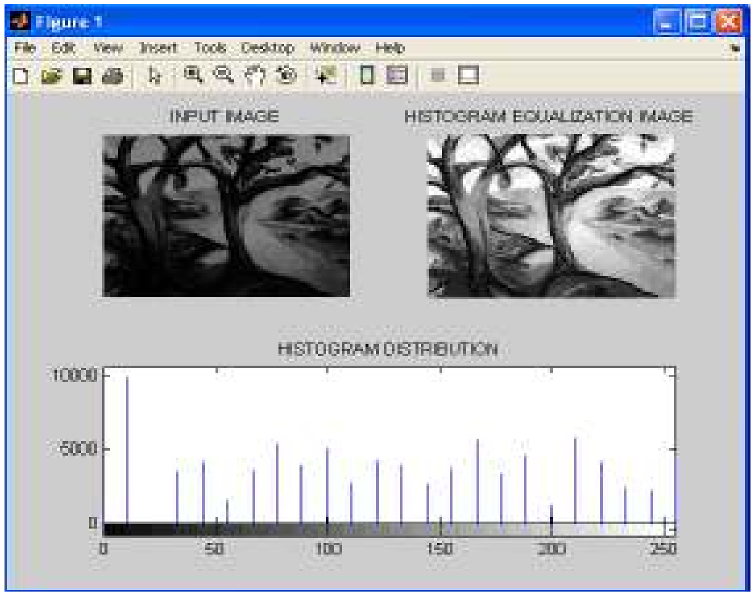

Fig. 1: Histogram image

1	1	1
1	1	1
1	1	1

Fig. 2: Box linear filter

Spatial filtering: A traditional way to remove noise from the image data is employed with spatial filter. In an input image moving a centre pixel creates a new neighborhood pixel. This operation leads to spatial filtering or neighborhood processing. If the Pixels of neighborhood are linear, then we can say linear spatial filtering or otherwise non linear spatial filtering.

The masking process is used whenever there is blurring in the image. The blurred portion can be represented as a sub image and the masking window is called kernel window or template or simply we can call it as window (Dong *et al*., 2011).

Classification of spatial filtering: It can be further sub divided into linear and non linear spatial filtering.

Linear spatial filter: In general linear spatial filter image size and filtering image size expression is given by Eq. (2):

$$\text{Processing Image } g(x,y) = \sum_{s=-a}^{a} \sum_{t=-b}^{b} w(s,t) f(x+s, y+t) \quad (2)$$

where, x and y are varied so that each pixel in ‘w’ visits every pixel in ‘f ’.

‘W’ is window masking of either spatial correlation or spatial convolution type (Gonzalez and Woods, 2012).

Normally spatial filter correlation is better than spatial filter convolution, because, in correlation process of passing the mask ‘w’ by the image array of ‘f’. But in convolution same process is adopted except that ‘w’ is rotated by 180° prior to passing it by ‘f’.

Spatial filter can be sub divided based on the noise smoothening spatial filter and sharpening spatial filters. For smoothing and sharpening gradient sobel operator or laplacian sobel operators are used preferably (Joshi *et al*., 2009; Zhang *et al*., 2010).

Smoothing spatial filter: In this filter every pixel in an image; the masking is average of pixel intensity. The response is given by Eq. (3) to (5):

$$\text{Response } R = w_1z_1 + w_2z_2 + w_3z_3 + w_4z_4 + w_5z_5 + w_6z_6 + w_7z_7 + w_8z_8 + w_9z_9 \quad (3)$$

$$\text{Response } R = \sum_{k=1}^{9} Wk\ Zk \quad (4)$$

$$\text{Average filter } Ravg = \frac{1}{9} \sum_{k=1}^{9} Wk\ Zk \quad (5)$$

where,
w = Masking window default 3 by 3 matrix
z = Gray level of the pixel

Smoothening spatial filter mainly is used for the purpose of removing/suppressing blurring. For doing this process we are mainly concentrating on weighted average smoothening filter compare to box linear filter.

Box linear filter: The entire 3×3 matrix pixel intensity value is same. So the average filters response in 1 by 9 of box linear filter is shown in Fig. 2.

Weighted average filter: In 3×3 matrix pixel intensity is based on the center pixel weights. If the weight is increased the performance of smoothening is good. The adjacent pixel weights are half of the weights of centre pixel and the diagonal always maintain the weights 1. This can be obtained by Eq. (6) (Gonzalez and Woods, 2012):

$$\text{Processing Image } g(x,y) = \sum_{s=-a}^{a} \sum_{t=-b}^{b} \frac{w(s,t)\, f(x+s, y+t)}{\sum_{s=-a}^{a} \sum_{t=-b}^{b} w(s,t)} \quad (6)$$

where, x and y are varied so that each pixel in 'w' visits every pixel in 'f'.

Sharpening spatial filter: Sharpening is used to highlight transition in intensity. It is used mainly in electronic printing, medical imaging, industrial inspection and autonomous guidance in military applications.

Non linear filter: Median and max filters are come under this domain.

Fig. 3: Input image

Fig. 4: Gaussian noise image

Fig. 5: Salt and pepper noise image

Fig. 6: Gaussian image using average filter

Median filter will replace the value of a pixel by the median of the intensity values in the neighborhood of that pixel. It is suitable for analyzing random noise and salt pepper noise (impulse noise) (Yan, 2013).

Max filter which is useful for finding the brightest points in an image.

Existing algorithm:

1. View the input image as shown in Fig. 3.
2. Add Gaussian noise to an input image and view the response as shown in Fig. 4.
3. Similarly add salt and pepper noise to an input image and view the response as shown in Fig. 5.

4. Use average filter to filter the Gaussian noisy image in the input image and view the response as shown in Fig. 6.
5. Use average filter to filter the salt and pepper noisy image in the input image and view the response as shown in Fig. 7.

Proposed algorithm: In the existing algorithm, with the help of average filter the filtering of noises from the input image is not improved much in both Gaussian noise as well as salt and pepper noise. So in the proposed algorithm, median filter is the suitable one comparing with average filter to filter the noisy from

Fig. 7: Salt and pepper image using average filter

Fig. 8: Median filter responses using Gaussian noise

Fig. 9: Median filter responses using salt and pepper noise

Fig. 10: Existing and proposed result

the input image. The comparisons of Gaussian with salt and pepper noise, median filter are mostly adopted with salt and pepper noise.

Impulse noise is often introduced by malfunctioning pixels in camera sensors, fault memory location in hardware or bit error in transmission:

- Repeat existing algorithm steps 1 to 3.
- Use median filter to filter the Gaussian noisy image in the input image and view the response as shown in Fig. 8.
- Use median filter to filter the salt and pepper noisy image in the input image and view the response as shown in Fig. 9.

RESULTS

Median filter with Salt and pepper noise is the only way to analyze the blurring of noise in an original image compared to average filter as shown in Fig. 10.

DISCUSSION

Performance of denoising algorithm is measured either by using quantitative or by using qualitative measures. Many of the current techniques assume that the noise model is to be Gaussian. But in reality this assumption may not be always true due to the varied nature and sources of noise. In some cases impulse noise also play a major role in some applications like video processing, image processing and surveillance.

Depends upon the research domain specific and real world problem the algorithm may be different.

Fast Fourier Transform (FFT) filtering is restricted due to its limitations in providing sparse representation of data. Wavelet Transform (WT) is best suited in many places like audio processing, speech processing. Because of its performance and prosperities like sparsity, Multi Resolution Analysis (MRA) and multi scale in nature. Wavelet dyadic coding principle mainly is helpful in image denoising and compression process (Afonso *et al*., 2010).

CONCLUSION

The combined image enhancement smoothening technique is mainly adapted to all image capturing and processing devices which are mainly used for various applications such as surveillance and video conferencing and other purposes. STK1262B Digital camera controller is the device which supports all these image enhancement and denoising features (Zitnick and Parikh, 2012).

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