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EFFICIENT HYBRID FILTER TECHNIQUE TO REMOVE SPECKLE NOISE

R. AMUDA [#1], K. BHUVANESHWARI [*2]

[#1] *Research Scholar, Department of Mathematics, Mother Therasa Women's University Kodaikanal – 624 102, Tamil Nadu, India.*

[#1] *Associate Professor, Department of Mathematics, Jeppiaar Institute of Technology, Chennai – 631 604, Tamil Nadu, India.*

[#2] *Associate Professor, Head and Department of Mathematics,Mother Therasa Women's University Kodaikanal – 624 102, Tamil Nadu, India.*

[1]amuda@jeppiaarinstitute.org

ABSRACT

Filters provide an aid to visual interpretation of images. So the design of filters in image processing is important to de-noise the images, to emphasize edges and to transform the correct images Filters depend on the type of noise present on the images. A new hybrid Filter DWT filters followed by Average filter is introduced to de-noise the speckle noise and investigated the performance on the images .

Keywords: DWT filters, Average Filters and cascaded filters.

INTRODUCTION

Digital topology is a mathematical tool in image processing.It digitalise the continuous image to discrete which is acceptable by computers vision and computer graphics..Most images are affected by noise that is unexplained variation in data and disturbance in image intensity. Image analysis is simplified if this noises are filtered.The design of filters are framed using mathematical analysis

sources of noise in the digital image [1]are

- environmental conditions
- Insufficient Light levels and sensor temperature
- Interference in the transmission channel
- If dust particles are present on the scanner screen

Image noise can be classified[2] as

- Impulse noise (Salt-and-pepper noise)
- Amplifier noise (Gaussian noise)
- Shot noise, Quantization noise (uniform noise)
- Shot noise, Quantization noise (uniform noise),
- Film grain, on-isotropic noise, Multiplicative noise (Speckle noise)
- Periodic noise.

De-noising filters can be categorized[4] in the following categories:

- Averaging filter
- Order Statistics filter
- Adaptive filter

The best filters are one which remove the noise completely from the image, while preserving the details. To develop filters which can preserve the features of the area of interest are in need . In this paper a hybrid filtering technique is adapted to remove speckle noise in images.

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Several different methods are used to eliminate speckle noise, based upon different mathematical models. but a new hybrid Filter DWT filters followed by Average filter is introduced to de-noise the speckle noise and investigated the performance on two different images .

DISCRETE WAVELET TRANSFORM

Different types of Wavelet transforms are existed for specific purposes.

- Continuous wavelet transform
- Discrete wavelet transform
- Complex wavelet transform
- Dual wavelet transform

,A discrete wave let transform(DWT) is a wavelet transform for which the wavelets are discretely sampled. It captures both frequency and location information.

DWT transforms the changes in time extension, but not shape. There are different type of discrete Wavelet transforms .

- Haar Wavelet transforms
- Daubechies Wavelet transforms
- The dual-tree complex Wavelets transforms

Haar Wavelet transforms(HWT)

For an input of 2^nnumbers Haar Wavelet transforms, storing the difference and passing the sum. This processes is repeated recursively till to lead 2^{n-1}difference and a final sum. This is the Fast wavelet transform, an alternate to Fast Fourier transform.

Daubechies Wavelets Transforms (DWT)

The formulation is based on the recurrence relations to generate progressively finer discrete samplings of an implicit mother wavelet function. Each resolution is twice that of previous scale.

The Dual-Tree complex wave Transform(DCT)

It is invariant and directionally selective in two and higher dimensions.

Mean Filtere

It is a linear filter . it computes the mean value of the corrupted image. Then the center pixel intensity value is replaced by the mean value. This process is applied to all pixel values in the image.Fig-1b) shows the effect of using mean filter on speckle noise.

Speckle noise

Speckle noise is caused by signals from elementary scatters in medical literature, it is referred as 'texture' and it may contain useful diagnostic information. The filters filter the more relevant details of the images. So it is essential to develop filters which can preserve the essential details of the images. Based on different mathematical models several hybrid filters are used. In this work a hybrid filtering technique is adapted to remove speckle noise. A cascaded filter technique is used . .cascade filter is a low pass filter and a high pass filter to produce a band pass filter. In this paper DWT filter followed by mean filter is introduced as a cascaded filter. this technique is applied in two images and the results are compared with existed filters.

ANALYSIS AND DISCUSSIONS

The proposed hybrid filtering techniques are applied to two figures to check the quality of the images. The quality of the enhanced images is measured by the statistical quantity measures: Root Mean Square Error (RMSE) and Peak Signal-to-Noise Ratio (PSNR) The performance of hybrid filtering techniques is analyzed and discussed.

$$MSE=\sqrt{\sum\frac{(f(i,j)-g(i,j))^2}{mn}}$$

$$PSNR=20\log log_{10}\frac{255}{MSE}$$

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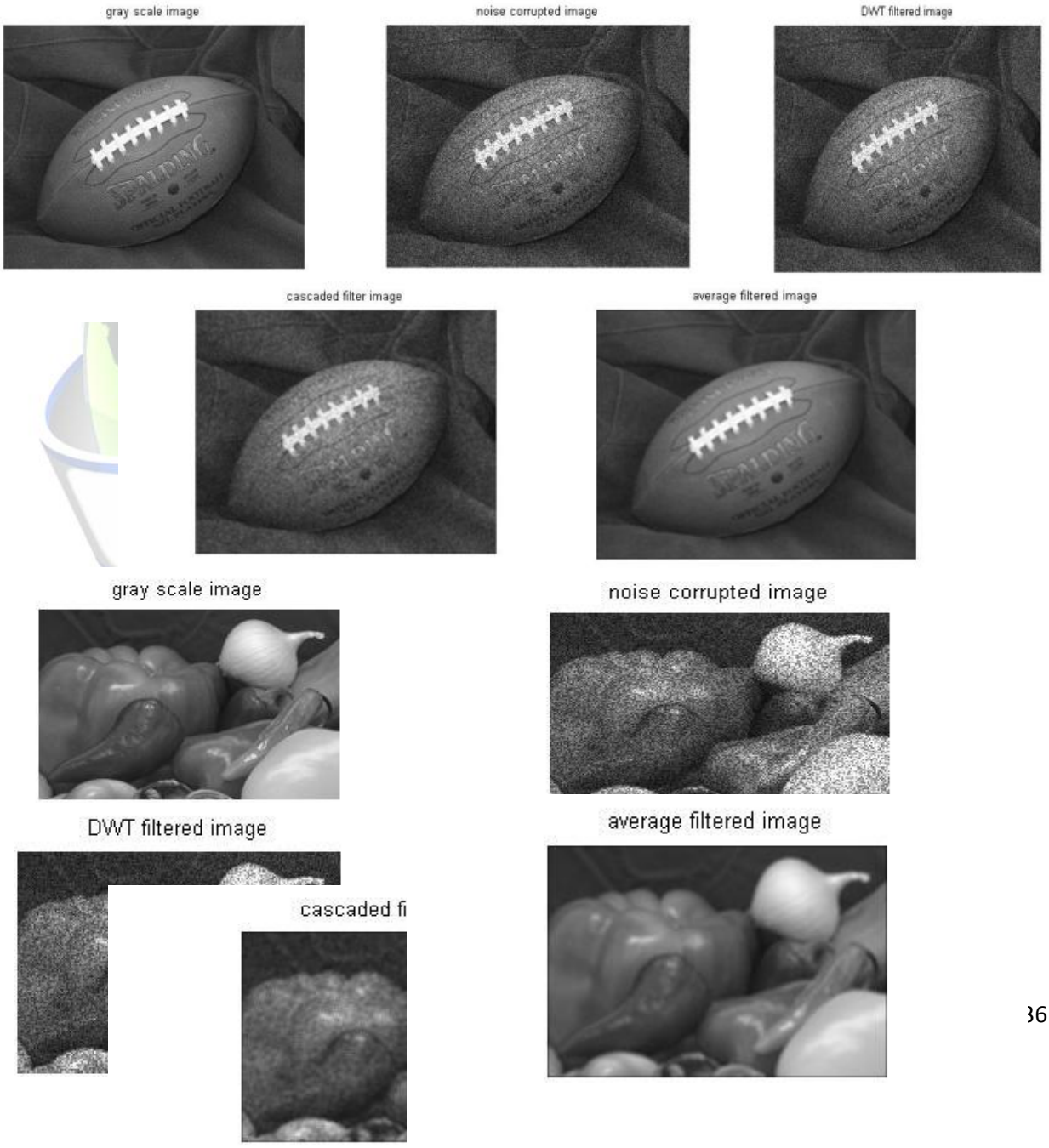
Here f (i,j) is the original image with speckle noise , g(i,j) is an enhanced image and m and n are the total number of pixels in the horizontal and the vertical dimensions of the image.

Table-1 shows the RMSE and PSNR values for noisy images. The Root Mean Square Error (RMSE) and Peak Signal-to-Noise Ratio (PSNR) are used to evaluate the enhancement of Foot ball,onion images. If the value of

RMSE is low and value of PSNR is high then the enhancement approach is better(2).

The original speckle noisy image and filtered images of Foot ball,onion images obtained by DWT, AVERAGE, CASCADE filtering techniques are shown in Figure-1 and Figure-2. Table-1 shows the proposed CASCADE filtering techniques that are compared with some existing filtering techniques namely, DMT(HWT&DWT), AVERAGE .



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VI. RESULTS

Table-1 shows the RMSE and PSNR values for speckle noisy images .

FOOT BALL FIGURE				ONION FIGURE		
Type of filters	MSE	PSNR	SNR	MSE	PSNR	SNR
HWT	3.4242	37.4397	62.2554	2.5512	39.9959	65.1487
AVERAGE	3.4249	37.4378	61.2544	2.5327	40.0590	65.2487
CASCADE	3.4249	37.4379	62.1885	2.5515	39.9949	65.5609

FOOT BALL FIGURE				ONION FIGURE		
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CONCLUSION

Different types of noise that creep in images during image acquisition or transmission are discussed. In the second section the various filtering techniques are applied to de-noise the images. Experimental results are presented to conclude that CASCADED filter performed well. For visual interpretation, smoothing the texture may be less desirable. Physicians generally have a preference for the original noisy images, more willingly, than the smoothed versions because the filter, even if they are more sophisticated, can destroy some relevant image details. Thus it is essential to develop noise filters which can preserve the features that are of interest to the physician. Several different methods are used to eliminate speckle noise, based upon different mathematical models of the phenomenon. A hybrid filtering technique for removing speckle noise in images is introduced. The mean filters performed well but also blurs desired edges. So cascaded filter is the best choice of removing the speckle noise.

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