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Analysis of Image Restoration Techniques at Different Noises

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Abstract -This paper generally designed to comparatively the performance of different image restoration technique. The images are degraded by numerous parameters like noises in the environment or blurring of the image during image gaining or during processing of the image. In order to improve the quality of the image so that the required objects can be easily available from the sensed images. It improves the objectivity of the image and removes the noise and blurry content in the image. In this paper we are allowing for four most popular image restoration techniques similar to Wiener Filter and Lucy-Richardson Method, and Blind De-Convolution and regularized filter. The performances of these techniques are evaluated and compared. Different performance parameters are considered to check the efficiency of technique.

Keywords: **Image Processing, Image Restoration, Noise, Blur, Degradation. Lucy Richardson, Wiener**

1 INTRODUCTION:

Image restoration techniques are methods which effort the inversion of several degrading process. Image-restoration technique can be broadly classified into two types depending upon the knowledge of degradation. If the previous knowledge concerning degradation is known subsequently the deterministic method of image restoration can be employed. The blur may be due to a number of reasons, such as motion defocusing, and atmospheric turbulence the noise may originate inRestoration techniques model the degradation process and attempt to apply an inverse procedure to obtain an approximation of the original imageThe original image. Many image restoration algorithms have their roots in well developed areas of mathematics such as estimation theory, the solution of ill-posed problems, linear algebra and numerical analysis. Iterative image restoration techniques often attempt to restore an image linearly or non-linearly by minimizing some measures of degradation such as maximum likelihood, constrained least square, etc. Blind restoration techniques attempt to solve the restoration problem without knowing the blurring function.

2 PROPOSED METHOD:

A novel image fusion method based on DWT is used.The main objective of this thesis is to compare different image restoration method is to perform improved image fusion in the presence of unknown image degradation. The task of image restoration is regularly performed earlier to and separate from fusion. This solution is suboptimal as the information from the fusion process can often contain relevant information to get better the restoration which be able to turn provide improved fusion. Methodology used will maintain the required information from both images we provide general overview of the propose technique.

3 INVERSE FILTERING

Direct inverse filtering is the simplest approach to restoration. In this method, an estimate of the Fourier transform of the image $\acute{f}(u,v)$ is computed by dividing the Fourier transform of the. degraded image by the Fourier transform of
the degradation function

$$\acute{f}(u,v)^{'} = \frac{G(u,v)}{H(u,v)}$$

This method works on form when convenient is none additive noise in the degraded image. That is, when the degraded image is given by

$g(x;\ y) = f(x;\ y) * h(x;\ y).$

But if noise gets added to the degraded image then the result of direct inverse filtering is very poor. Equation gives the expression for $G(u;\ v)$. Substituting for $G(u;\ v)$ in the above equation, we get

$$f(u,v) = \acute{f}(u,v)^{'} + \frac{N(u,v)}{H(u,v)}$$

The above equation shows that direct inverse filtering fails when additive noise is present in the degraded image. Because noise is random and so we cannot find the noise spectrum $N(u;\ v)$.DLR is a non blind technique of image restoration, used to restore a degraded image that has been blurred by a recognized PSF. It is an iterative formula in which the pixels of the observed image are represented using the PSF and the latent image as follows: [14]

4 WIENER FILTER

Weiner Filtering is also a non blind technique designed for reconstructing the degraded image within the existence of known PSF. It removes the additive noise and inverts the blurring simultaneously. It not merely performs the deconvolution through inverse filtering (highpass filtering) but also removes the noise with a density operation (lowpass filter). It compares with an estimation of the preferred noiseless image. The input to a wiener filter is a degraded image distort by additive noise. The output image is computed by means of a filter using the following expression: [12]

In equation (1), f is the original image, n is the noise, f'' is the estimated image and g is the wiener filters response.

$$f'' = g * (f + n)$$

5 LUCY RICHARDSON ALGORITHM

DLR is a non blind technique of image restoration, utilize to restore a degraded image so as to has been blurred by a

known PSF. It is an iterative procedure in which the pixels of the observed image are represented using the PSF and the latent image as follows: [12]

$$d_i = \Sigma\, p_{ij}\, u_j$$

d_i is the examine value at pixel situation „i“, p_{ij} is the PSF, the fraction of light impending from accurate position „j“ that is observed at position„ i“, u_j is the latent image pixel value at position „j“. The main objective is to calculate the most likely „u_j“ in the presence of observed d_j and known PSF p_{ij} as follows: [12]

$$u_j^{t+1}=u_j^t\sum_i \frac{d_i}{c_i}p_{ij} \qquad c_i = \sum_j p_{ij}u_j^{(t)}$$

6 Wavelet Transform In Two Dimensions

A two-dimensional scaling function, W(x, y), and three two-dimensional wavelet ψ^H (x,y) , ψ^V (x, y), ψ^D (x,y) are critical elements for wavelet transforms in two dimensions [2]. These scaling function and directional wavelets are composing of the product of a one-dimensional scaling function φ and corresponding wavelet ψ which are demonstrated as the following:

$$W(x, y) = W(x)\, W(y)$$
$$\psi^H(x,y) = \psi(x)\, W(y)$$
$$\psi^V(x, y) = W(x)\, \psi(y)$$
$$\psi^D(x,y) = \psi(x)\, \psi(y)$$

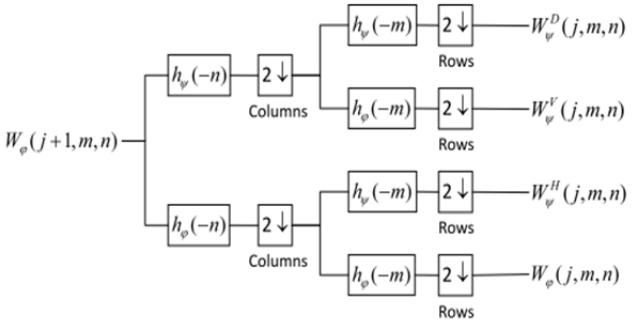

Fig 1 the analysis Filter bank of two dimensional FWT

where ψ^H measures the horizontal variations (horizontal edges), ψ^V corresponds to the vertical variations (vertical edges), and ψ^D detects the variations along the diagonal directions.shown in fig.2

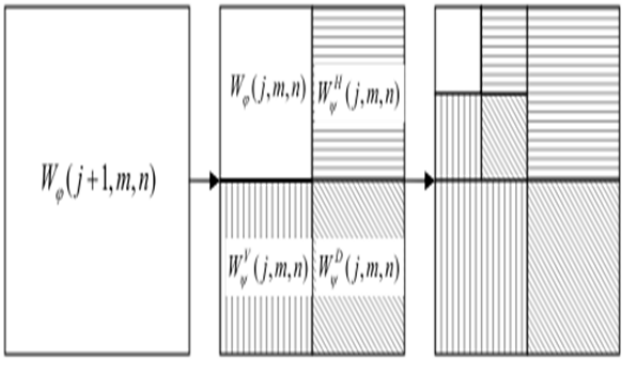

Fig 2 A two level decomposition of the two-dimensional DWT

7 Algorithm For DWT

Decompose each input image into subbands by applying DWT For each subband pair X & Y, except the lowpass residuals: Compute wavelet coefficient value σ_X and σ_Y . Find the absolute different between them

$$D = abs(\sigma_X) - abs(\sigma_Y)$$

Calculate the fused coefficients using the formula $Z = W_X \sigma_X + W_Y \sigma_Y$

if D < 0 then,
Wx = 0 and Wy = 1 – Wx
Then D > 0
Wx = 1 & Wy= 1 – Wx

Average coefficients in low pass residuals. Reconstruct the fused image from the processed subbands and the lowpass residual by applying inverse DWT

8 Result Analyses

Image restoration using different types of image restoration techniques the experimental result show in term of signal to noise ratio and mean square error Blind Deconvolution fused with Lucy Richardson, In this two input image are taken on that images we include PSF's then we get the blur image the we applied Blind Deconvolution and lucy Richardson methods on the two separate images then we Fused that two image using wavelet based image fusion and then again applied DWT on that Fused image and then calculate SNR and MSE. other method for restoration and last we compare the result on the basis of calculated SNR and MSE. Experimental Results Mse Comparison With Respect To Various Images shown in fig.3,4,5,6

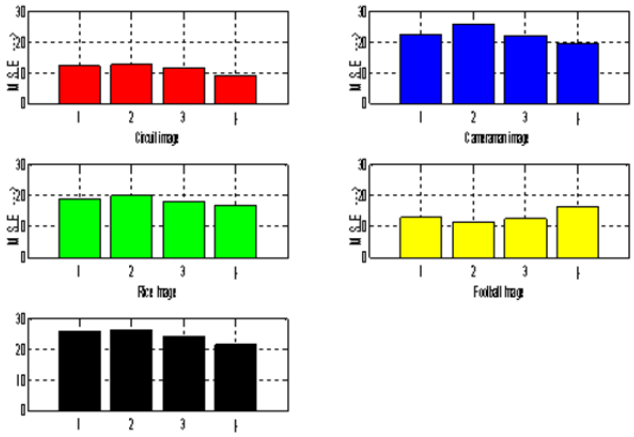

Fig 3 Blurred Image 2.Fused blind with Lucy Richardson 3. Fused Wiener with Lucy Richardson 4. Fused Regularized with lucy Richardson

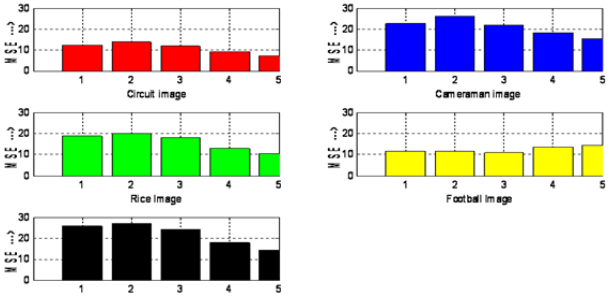

Fig.4,1.Blurred Image 2.Blind deconvolution 3.Lucy Richardson 4.Wiener Filter 5.Regularised Filter

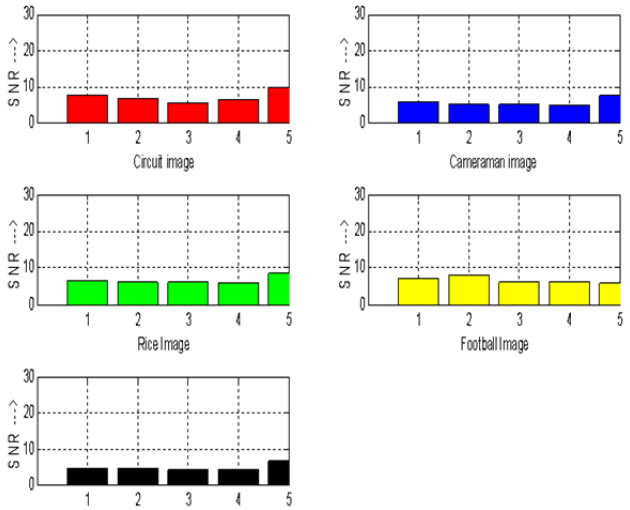

Fig.5 1.Blurred Image 2.Blind deconvolution 3.Lucy Richardson 4.Wiener Filter 5.Regularised Filter

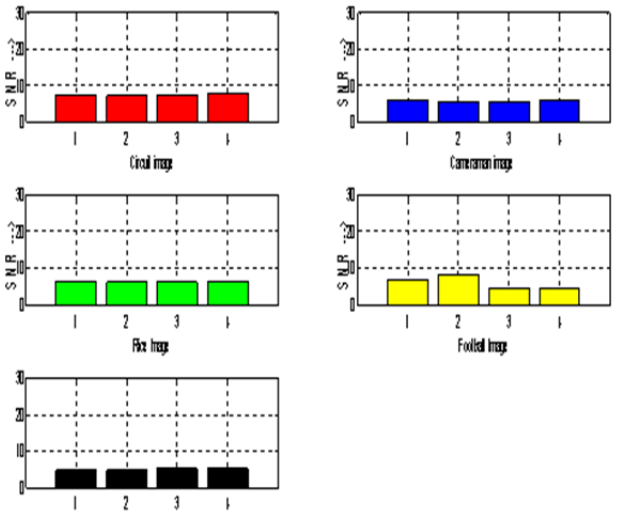

Fig.6 Blurred Image 2.Fused blind with Lucy Richardson 3. Fused Wiener with Lucy Richardson 4. Fused Regularized with Lucy Richardson

Table 1 Comparison of SNR using various Images

Images	Processing	Lucy Richardson	Lucy with blind	Lucy with wiener	Lucy with regularized
C	Filtering	7.2254	6.4945	6.2334	9.9564
Cam	Filtering	5.9156	5.1039	4.7321	7.302
Rice	Filtering	6.3467	5.9353	5.6868	8.547
Football	Filtering	7.0844	7.0844	6.1467	5.7663
Circle	Filtering	4.5907	4.4008	4.0396	6.5915
C	Fused Restored	7.2254	7.1656	7.2528	7.7201
Cam	Fused Restored	5.9156	5.2098	5.3486	5.9748
Rice	Fused Restored	6.3467	5.992	6.0818	6.5807
football	Fused Restored	4.3089	4.5645	4.5615	4.6819
circle	Fused Restored	4.5907	4.5484	4.8238	4.8976

Table 2 Comparison of MSE using various Images

Images	Processing	Blind Deconvolution	Lucy Richardson	Lucy with blind	Lucy with wiener	Lucy with regularized
C	Filtering	12.377	13.77	14.347	8.9824	6.828
Cam	Filtering	22.668	26.273	28.338	18.244	15.252
Rice	Filtering	18.764	20.064	20.941	12.933	10.541
football	Filtering	11.7474	10.4511	13.5398	14.4346	18.4643
circle	Filtering	25.796	26.909	29.03	17.996	14.231
C	Fused Restored	12.377	12.481	12.331	11.584	9.154
Cam	Fused Restored	22.6668	25.739	25.0714	22.286	19.543
Rice	Fused Restored	18.764	19.85	19.581	18.096	16.803
football	Fused Restored	14.3495	19.5153	18.2318	18.2437	17.7747
circle	Fused Restored	25.796	26.036	24.55	24.18	21.21

9 CONCLUSION

This paper has demonstrated the various restoration performance that have been developed developed to restore the toward renovate the original image from the degraded image. To summarize, it is concluded that filters are an important engineering technique which help to construct a good quality image through removing noises from an image which are bound to creep into an image because of various reasons which may be controllable or sometimes uncontrollable. now mostly four techniques have been simulated as well as compared. The results show that the performance by the LR Weiner filter is good, other than the presentation of Regularized filter is nastiest in case of all types of noises. The performance of Blind deconvolution is good compared to regularized filter and poor when compared with Weiner and Lucy Richardson methods.

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