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De-Noising and Contrast Enhancement Using Bilateral Filter and Adaptive Histogram Equalization.

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ABSTRACT

Image enhancement is a process of refining the quality of the image in digital image processing. Here CLAHE algorithm and bilateral filter is used. Enhancement of an image which includes contrast and sharpness is required in many applications. One of the most common problem arise is due to weather conditions, fog has whitening effect which leads to the decline of image contrast and also produces mistily to the image. Since it can be seen that the low gray value is strengthened, the high gray value is weaken, leading to the over-concentrated distribution of pixel gray value, which is leads to the contrast degradation problem, therefore the blurrily image's restoration can be regarded as the image contrast enhancement problem. Firstly, carry on the Dual-Tree complex wavelet decomposition to the image then obtain the low and high frequency components of image, using the Bilateral filter to low-frequency component, while utilize soft threshold based on level dependent threshold estimation to process high-frequency components, after that in proposal, principal feature will be separated from low frequency and it is modified with certain enhancement factor and eventually carry on wavelet restructuring to the processed components. Finally the simulated results shows that used approaches provides better accuracy in image contents preservation with high signal to noise ratio rather than exist methods.

Keywords: Luminance, Chrominance, Histogram, Contrast Enhancement, Bilateral Filter.

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INTRODUCTION

A digital device as a consumer digital camera often suffers from varying light conditions because of its narrower dynamic range. The captured image could contain underexposed and overexposed regions. And the image has low local contrast in both underexposed and overexposed areas. Therefore an enhancement algorithm which enhances the image's visual quality. This paper discusses the issue of illumination estimation in many enhancement algorithms that are based on decomposition. The exception that avails the contrast enhancement is also specified. A method on the limited contrast enhancement that results from the low smoothing capability of a traditional nonlinear filter. Here the algorithm used achieves better visual quality than some previous algorithms. Here the contrast of the color image is enhanced. The noisy image is de-noised using the proposed algorithm with better techniques Madhava V, Yogesh R, K Srilatha et al [12]. By this the illumination problems are resolved and gives us a better contrast enhancement and smoothens the image and preserves the edges. The better technique usually improves the visual quality of the image without losing the information of the original image.

Existing Method

The existing method nonlinear diffusion model is in order to avoid the image blurring of boundaries and further problems presented by means of linear diffusion models. The model is executed by applying a method that reduces the diffusivity in edges of the images. Determining when the distribution process should be stopped is critical for obtaining a fine picture reconstruction. Some authors have addressed this issue in the earlier period in an attempt to develop almost favorable stopping criterion. They argued that the minimal change by scale indicates especially stable scales with respect to evolution time, and conjectured that these balance could be fine candidates for stopping occasion in nonlinear diffusion processes. Weickert [1999b] also pointed out that the monotonically decreasing 'relative variance', $0 \leq \text{var}(u)/\text{var}(u_0) \leq 1$, could be used to measure the distance of u from the initial state u_0 and, by prescribing an appropriate value for the comparative variance, it can comprise a good criterion for stopping the nonlinear diffusion. The diffusion-stopping criterion inspired by observation of the behavior of the correlation between the de-noised image, correlation between the noisy image and the filtered image, $\text{corr}(u_0, u)$. The nonlinear diffusion process starts from the experiential figure, $u_0(\tilde{x})$, and creates a set of filtered images, $u(\tilde{x}, t)$, by steadily removing noise and details from scale to scale until, as $t \rightarrow \infty$, the image converges to a constant value Rongrong Ni et al [3].

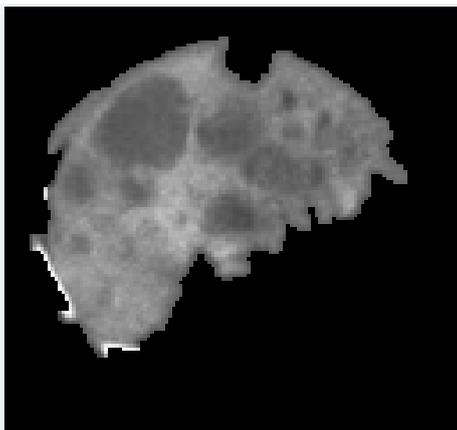


Fig 1: Input image

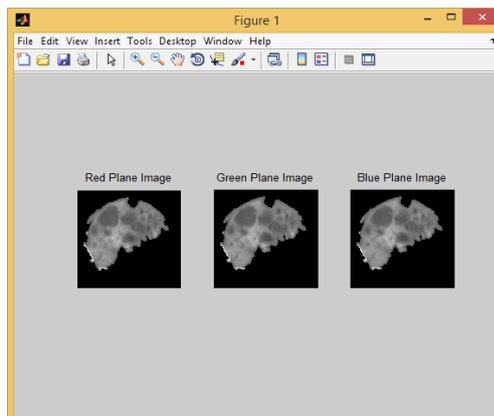


Fig 2: RGB image

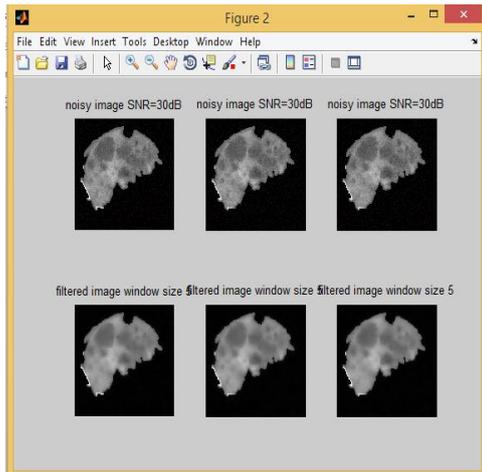


Fig 3: Filtered image

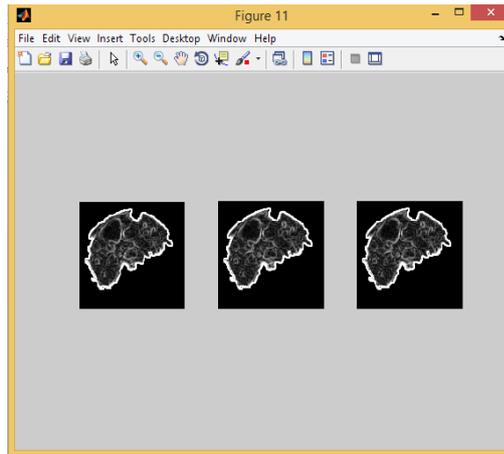


Fig 4: Edge deducted image

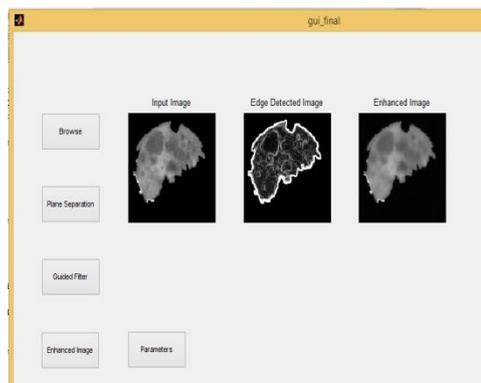


Fig 5: Output image

Proposed Method

Enhancement of an image which includes contrast and sharpness is required in many applications. The blurry image's restoration can be regarded as the image contrast enhancement problem Z.-G. Wang et al [14]. Firstly, carry on the Dual-Tree complex wavelet decomposition, and obtain the low frequency and high-frequency components of image, use the Bilateral filter to low-frequency component, while utilize soft threshold based on level dependent threshold estimation to process high-frequency components, after that in proposal, principal feature will be separated from low frequency and it is customized with certain enhancement aspect and ultimately carry on wavelet restructuring to the processed components M. Kim et al [7]. Finally the simulated results shows that used approaches provides better accuracy and improve the contrast of the enhanced image K.Srilatha, S.Kaviyarasu et al [4].The medical image is given as input and Conversion of image from RGB to ycbcr is done. And the dual tree complex wavelet decomposition is carried out ZhetongLianga et al [1].Then low frequency component and high frequency components are separated using bilateral filter.

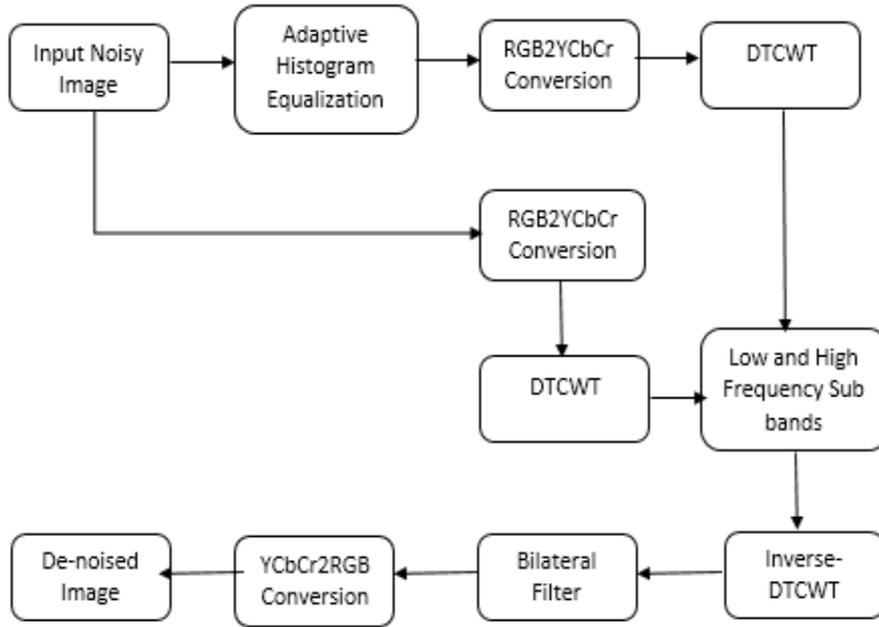


Fig 6: Block diagram of proposed method

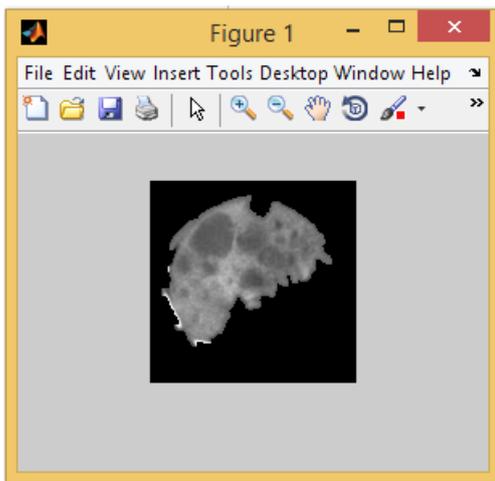


Fig 7: Input image

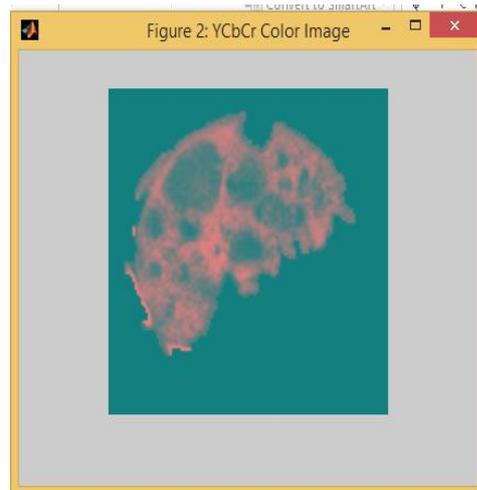


Fig 8: ycbcr image

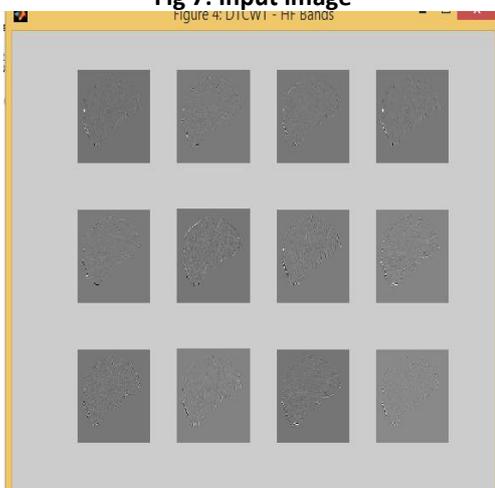


Fig 9: High frequency bands

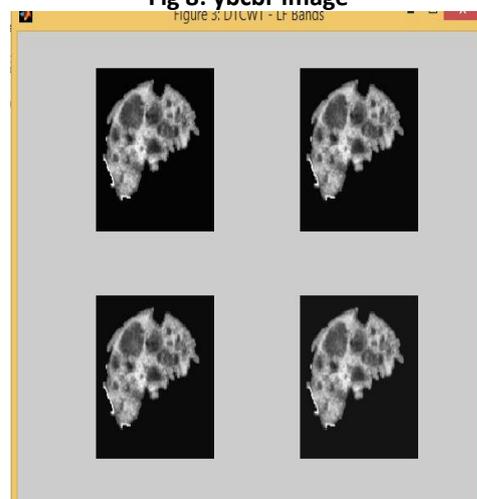


Fig 10: Low frequency bands

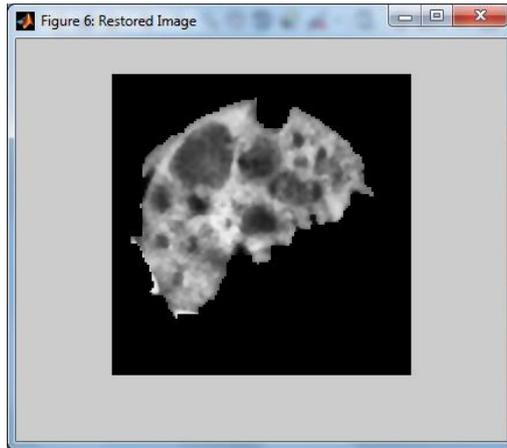


Fig 10: Restored image

RESULTS AND DISCUSSION

Here we discuss about the proposed algorithm and wavelet transform were it smoothen the image and the de noised image has higher efficiency than the existing method .By comparing the various parameters of existing and proposed method the proposed algorithm has higher accuracy. PSNR value is higher in proposed method compared to previous methods. The entropy, variance and standard deviation are also greater.

Table1: Parameter Analysis

S.NO	PARAMETER	GUIDED FILTER	BILATERAL FILTER
1	RMSE	9.282	3.5974
2	PSNR	38.4544	42.5709
3	ENTROPY	0.5396	2.9279
4	VARIENCE	0.1083	3.58E+03
5	STD DEVIATION	0.33	59.9
6	SPATIAL FREQUENCY	0.2032	45.0458

Graph Representing Parameters

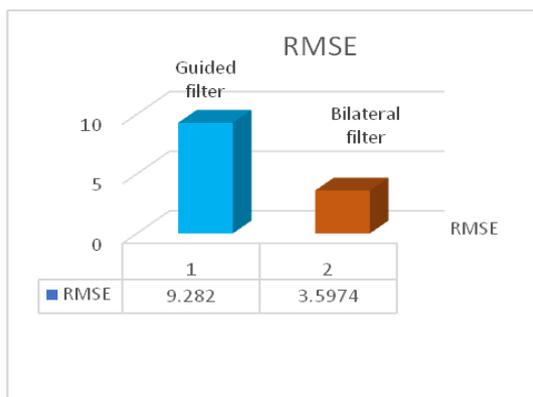


Fig 12: Graph for RMSE

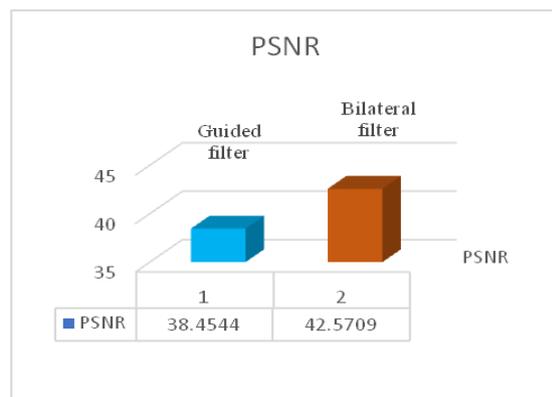


Fig 13: Graph for PSNR

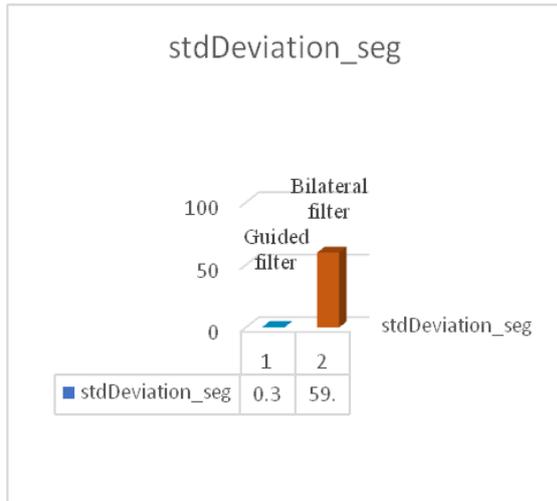


Fig 14: Graph for standard deviation

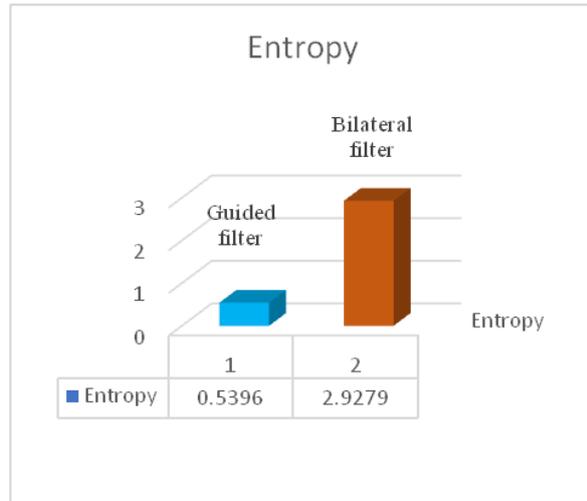


Fig 15: Graph for Entropy

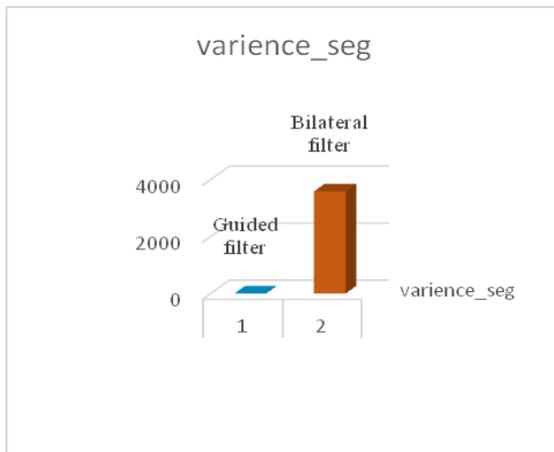


Fig 16: Graph for variance

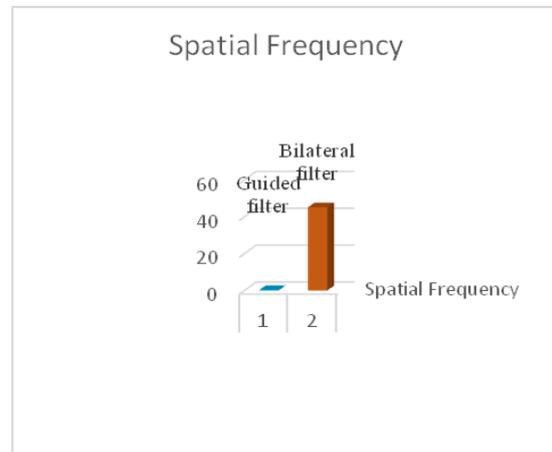


Fig 17: Graph for Spatial frequency

CONCLUSION

This paper discusses about the illumination problems and problem arises during the contrast enhance the color image, also the low frequency component gives smooth mask and high frequency component shows sharpened edges .And finally we provide the enhanced digital image by improving the quality of an image comparably high than the previous tasks enhancement of colour images. The algorithm is extended to the color channels without causing the graying effect. The luminance and chrominance are also accounted in it.

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