EVALUATION AND IMPROVEMENT OF ADAPTIVE FILTERS FOR SHARPNESS ENHANCEMENT AND NOISE REMOVAL

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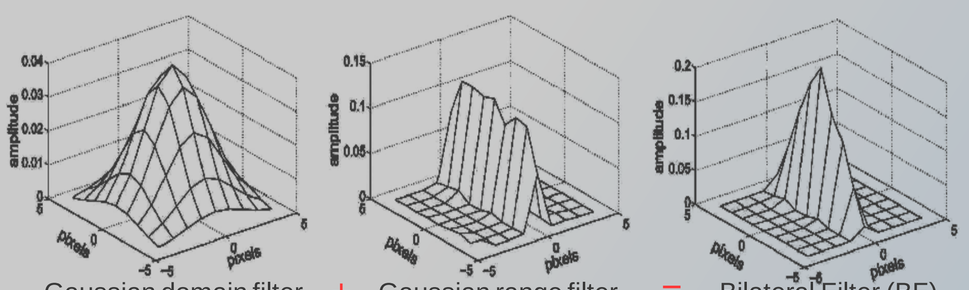
ABSTRACT

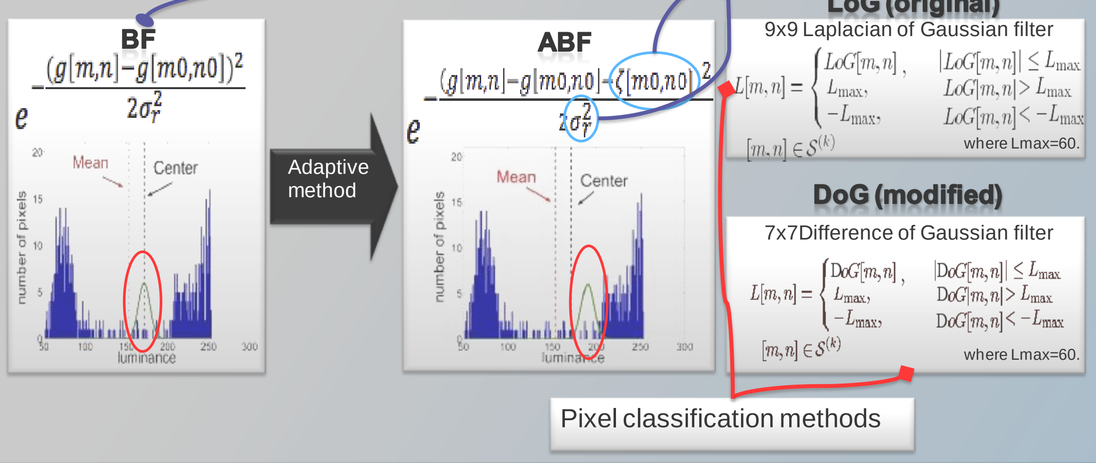
Two adaptive filter algorithms for sharpness enhancement and noise removal have been evaluated. A modification to the Adaptive Bilateral Filter(ABF) method [1] have been carried out improving the former results.
A metric comparision with adaptive Nonlinear Complex Diffusion Filter (NCDF) algorithm [2] has been done using three methods: MSE (mean square error), ENL (equivalent number of looks) and CNR (Contrast to noise ratio).

METHODS

ABF

ABF enhances the edges and remove noise transforming the histogram via a range filter with adaptive offset and width.





Adaptive NCDF

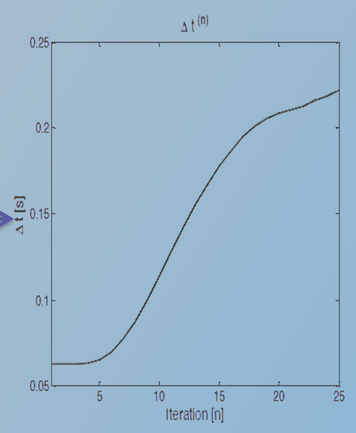
Adaptive NCDF uses a diffusion coefficient to preserve the location of the edges during the smoothing.

Nonlinear **C**omplex **D**iffusion **F**ilter

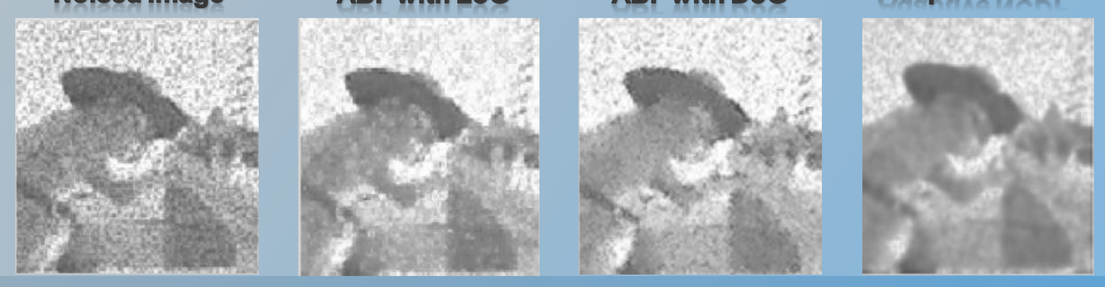
Adaptive method

Time step

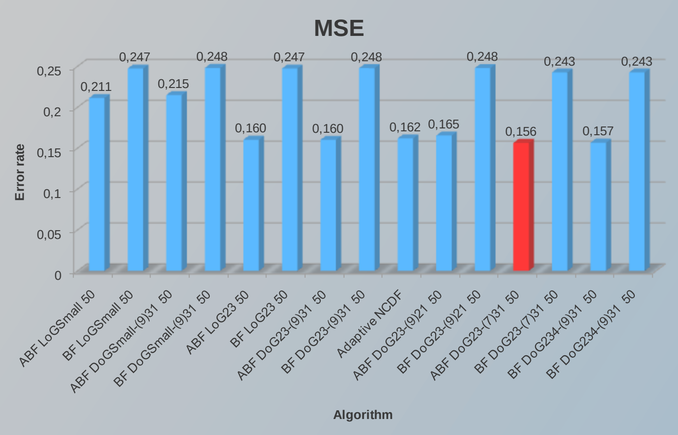
NO CONSTANT

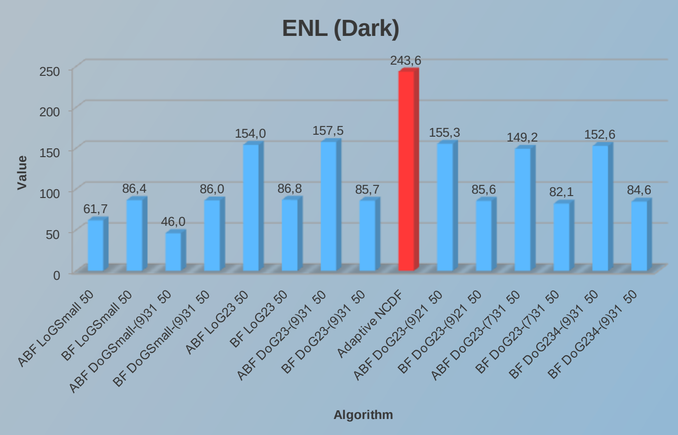


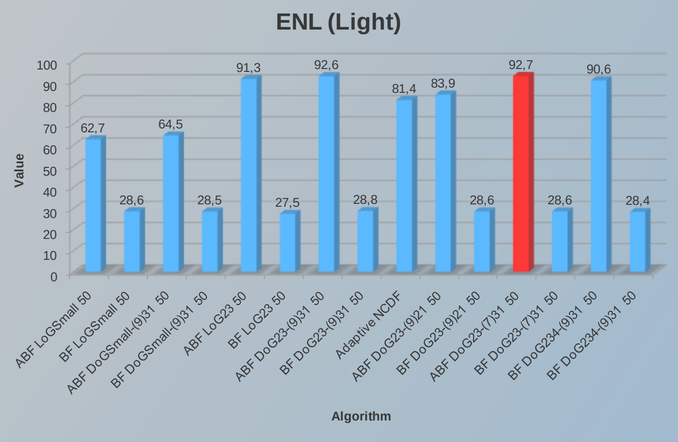
Examples

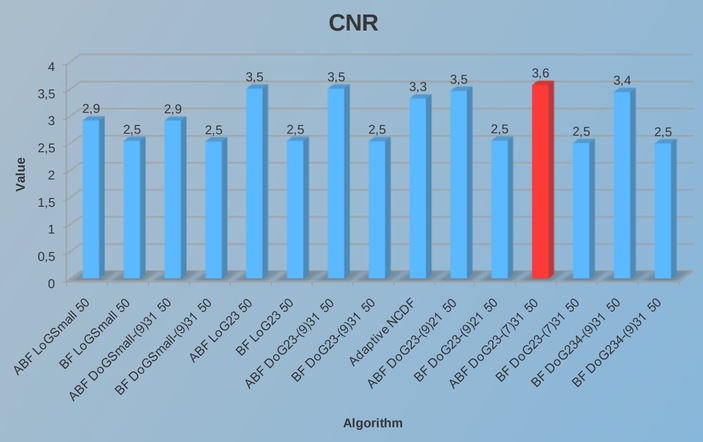


RESULTS









The modified ABF with a 7x7 gaussian kernel outperforms all the other algorithms using the ENL for light areas, CNR and MSE. The best result in the dark areas has been obtained by the Adaptive NCDF.

CONCLUSIONS

ABF method has been modified outperforming the original one using difference of gaussian (DoG) in pixel classification.

A 7x7 DoG obtains the best results in the MSE, ENL for light regions and CNR thus ABF method depends on the pixel classification method.

ENL (Dark) metric shows that the Adaptive NCDF is the best algorithm for these areas.

ACKNOWLEDGEMENT

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REFERENCES

[1] Buyue Zhang; Allebach, J.P.; "Adaptive Bilateral Filter for Sharpness Enhancement and Noise Removal," *Image Processing, IEEE Transactions on* , vol.17, no.5, pp.664-678, May 2008

[2] Rui Bernardes, Cristina Maduro, Pedro Serranho, Adérito Araújo, Sílvia Barbeiro, and José Cunha-Vaz, "Improved adaptive complex diffusion despeckling filter," Opt. Express **18**, 24048-24059 (2010)