

Result Table:1

Image	Sigma=20	Sigma=30
Peppers	Bilateral	24.6703
	Noised image	18.7662
Barbara	Bilateral	24.1778
	Noised image	18.7937
Lena	Bilateral	27.7501
	Noised image	18.7019

V. CONCLUSION

In this paper I have designed a scientific analysis of the optimal parameters value for bilateral filter in image denoising and present a multi resolution image framework which is combined with bilateral filter and wavelet threshold. Here I proposed decompose an image in low pass and high pass frequency components and apply bilateral filter method on the approximation sub bands. We got the maximum σ/r value of bilateral filter is linearly related to the standard derivation of noise. The maximum value of the σ/d is relatively separate of the noise power. Outcomes of the result we calculate the noise standard derivation for every level of the sub band decomposition and use a continues several of it for the σ/r value for bilateral filter.

References

- [1] D. L. Donoho and I. M. Johnstone, "Ideal spatial adaptation by wavelet shrinkage," *Biometrika*, vol. 81, no. 3, pp. 425–455, 1994.
- [2] D. L. Donoho, I. M. Johnstone, G. Kerkyacharian, and D. Picard, "Wavelet shrinkage: Asymptopia?," *J. Roy. Statist. Assoc. B*, vol. 57, no. 2, pp. 301–369, 1995.
- [3] S. G. Chang, B. Yu, and M. Vetterli, "Adaptive wavelet thresholding for image denoising and compression," *IEEE Trans. Image Process.*, vol. 9, no. 9, pp. 1532–1546, Sep. 2000.
- [4] J. Portilla, V. Strela, M. J. Wainwright, and E. P. Simoncelli, "Image denoising using scale mixtures of gaussians in the wavelet domain," *IEEE Trans. Image Process.*, vol. 12, no. 11, pp. 1338–1351, Nov. 2003.
- [5] A. Pizurica and W. Philips, "Estimating the probability of the presence of a signal of interest in multiresolution single- and multiband image denoising," *IEEE Trans. Image Process.*, vol. 15, no. 3, pp. 654–665, Mar. 2006.
- [6] L. Sendur and I. W. Selesnick, "Bivariate shrinkage functions for wavelet-based denoising exploiting interscale dependency," *IEEE Trans. Signal Process.*, vol. 50, no. 11, pp. 2744–2756, Nov. 2002.
- [7] L. Sendur and I. W. Selesnick, "Bivariate shrinkage with local variance estimation," *IEEE Signal Process. Lett.*, vol. 9, no. 12, pp. 438–441, Dec. 2002.
- [8] F. Luisier, T. Blu, and M. Unser, "A new sure approach to image de-noising: Inter-scale orthonormal wavelet thresholding," *IEEE Trans. Image Process.*, vol. 16, no. 3, pp. 593–606, Mar. 2007.
- [9] S. Lyu and E. P. Simoncelli, "Statistical modeling of images with fields of gaussian scale mixtures," in *Advances in Neural Information Pro-cessing Systems 19*, B. Schölkopf, J. Platt, and T. Hoffman, Eds. Cambridge, MA: MIT Press, 2007, pp. 945–952.
- [10] M. Elad and M. Aharon, "Image denoising via learned dictionaries and sparse representation," presented at the *IEEE Computer Vision and Pat-tern Recognition*, Jun. 2006.
- [11] M. Elad and M. Aharon, "Image denoising via sparse and redundant representations over learned dictionaries," *IEEE Trans. Image Process.*, vol. 15, no. 12, pp. 3736–3745, Dec. 2006.
- [12] J. Mairal, M. Elad, and G. Sapiro, "Sparse representation for color image restoration," *IEEE Trans. Image Process.*, vol. 17, no. 1, pp. 53–69, Jan. 2008.
- [13] K. Dabov, V. Katkovnik, A. Foi, and K. Egiazarian, "Image denoising with block-matching and 3D filtering," presented at the *SPIE Electronic Imaging: Algorithms and Systems V*, Jan. 2006.
- [14] K. Dabov, A. Foi, V. Katkovnik, and K. Egiazarian, "Image denoising by sparse 3D transform-domain collaborative filtering," *IEEE Trans. Image Process.*, vol. 16, no. 8, pp. 2080–2095, Aug. 2007.
- [15] K. Hirakawa and T. W. Parks, "Image denoising using total least squares," *IEEE Trans. Image Process.*, vol. 15, no. 9, pp. 2730–2742, Sep. 2006.
- [16] C. Tomasi and R. Manduchi, "Bilateral filtering for gray and color im-ages," in *Proc. Int. Conf. Computer Vision*, 1998, pp. 839–846.
- [17] J. S. Lee, "Digital image smoothing and the sigma filter," *CVGIP: Graph. Models and Image Process.*, vol. 24, no. 2, pp. 255–269, Nov. 1983.
- [18] L. Yaroslavsky, *Digital Picture Processing—An Introduction*. New York: Springer Verlag, 1985.
- [19] S. M. Smith and J. M. Brady, "Susan—A new approach to low level image processing," *Int. J. Comput. Vis.*, vol. 23, pp. 45–78, 1997.
- [20] M. Elad, "On the origin of the bilateral filter and ways to improve it," *IEEE Trans. Image Process.*, vol. 11, no. 10, pp. 1141–1151, Oct. 2002.
- [21] D. Barash, "A fundamental relationship between bilateral filtering, adaptive smoothing, and the nonlinear diffusion equation," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 24, no. 6, pp. 844–847, Jun. 2002.
- [22] A. Buades, B. Coll, and J. Morel, "Neighborhood filters and PDE's," *Numer. Math.*, vol. 105, pp. 1–34, 2006.
- [23] N. Sochen, R. Kimmel, and R. Malladi, "A general framework for low level vision," *IEEE Trans. Image Process.*, vol. 7, no. 3, pp. 310–318, Mar. 1998.
- [24] N. Sochen, R. Kimmel, and A. M. Bruckstein, "Diffusions and confu-sions in signal and image processing," *J. Math. Imag. Vis.*, vol. 14, no. 3, pp. 195–209, 2001.