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Abstract

Medical imaging is placing a major role in diagnosing the diseases and in image guided surgery. There are various imaging modalities for different applications giving the anatomical and physiological conditions of the patient. All these modalities will introduce some amount of noise and artifacts during medical image acquisition. If the noise and artifacts are not minimised diagnosis will become difficult. One of the non-invasive modality is ultrasound where no question of radiation but suffers from speckle noise produced by the small particles in the tissues whose size is less than the wavelength of the ultrasound. The presence of the speckle noise will cause the low contrast images where low contrast lesions and tumors can't be detected in the diagnostic phase. So there is a strong need in developing the despeckling techniques to improve the quality of ultrasound images. Many image denoising techniques based on spatial filtering, total variational filtering, bilateral filtering and multiresolution filtering etc. In most of the filtering techniques the objective is removing the noise while preserving the edges in the image. Still research is going on in the improvement of denoising procedures without losing the diagnostic details. Here in this paper we are proposing a method which will combine the bilateral filtering and multiresolution approach (Discrete Wavelet Transform) to remove the noise from ultrasound medical images. The advantage of this method is it removes the noise in the approximation subband or low frequency subband in

the wavelet decomposition. The performance of the filtering was evaluated using several image quality metrics and the results showed that the proposed hybrid filter is outperforming the methods based on wavelet transforms and spatial filtering.

References

- J. W. Goodman, "Some fundamental properties of speckle," J. Opt. Soc. Am. , vol. 66, no. 11, pp. 1145–1149, 1976.
- C. B. Burckhardt, "Speckle in ultrasound B-mode scans," IEEE Trans. Sonics Ultrasonics, vol. SU-25, no. 1, pp. 1–6, 1978.
- Z. Tao, H. D. Tagare, and J. D. Beaty. Evaluation of four probability distribution models for speckle in clinical cardiac ultrasound images. IEEE Transactions on Medical Imaging, 25(11):1483{1491, 2006.
- P. C. Tay, S. T. Acton, and J. A. Hossack. A stochastic approach to ultrasound despeckling. In Biomedical Imaging: Nano to Macro, 2006. 3rd IEEE International Symposium on, pages 221{224, 2006.
- J. S. Lee, "Digital image enhancement and noise filtering by using local statistics," IEEE Trans. Pattern Anal. Mach. Intell. , PAMI-2, no. 2, pp. 165–168, 1980.
- J. S. Lee, "Speckle analysis and smoothing of synthetic aperture radar images," Comp. Graphics Image Process. , vol. 17, pp. 24–32, 1981, doi:10.1016/S0146-664X(81)80005-6.
- J. S. Lee, "Refined filtering of image noise using local statistics," Comput. Graphics Image Process, vol. 15, pp. 380–389, 1981.
- V. S. Frost, J. A. Stiles, K. S. Shanmungan, and J. C. Holtzman, "A model for radar images and its application for adaptive digital filtering of multiplicative noise," IEEE Trans. Pattern Anal. Mach. Intell. , vol. 4, no. 2, pp. 157–165, 1982.
- D. T. Kuan and A. A. Sawchuk, "Adaptive noise smoothing filter for images with signal dependent noise," IEEE Trans. Pattern Anal. Mach. Intell. , vol. PAMI-7, no. 2, pp. 165–177, 1985.
- D. T. Kuan, A. A. Sawchuk, T. C. Strand, and P. Chavel, "Adaptive restoration of images with speckle," IEEE Trans. Acoust. , vol. ASSP-35, pp. 373–383, 1987, doi:10.1109/TASSP. 1987. 1165131.
- J. Saniie, T. Wang, and N. Bilgutay, "Analysis of homomorphic processing for ultrasonic grain signal characterization," IEEE Trans. Ultrason. Ferroelectr. Freq. Control, vol. 3, pp. 365–375, 1989, doi:10.1109/58.19177.
- A. Pizurica, A. M. Wink, E. Vansteenkiste, W. Philips, and J. Roerdink, "A review of wavelet denoising in mri and ultrasound brain imaging," Curr. Med. Imag. Rev. , vol. 2, no. 2, pp. 247–260, 2006.
- D. L. Donoho, "Denoising by soft thresholding," IEEE Trans. Inform. Theory, vol. 41, pp. 613–627, 1995.
- X. Zong, A. Laine, and E. Geiser, "Speckle reduction and contrast enhancement of echocardiograms via multiscale nonlinear processing," IEEE Trans. Med. Imaging, vol. 17, no. 4, pp. 532–540, 1998.

- X. Hao, S. Gao, and X. Gao, "A novel multiscale nonlinear thresholding method for ultrasonic speckle suppressing," IEEE Trans. Med. Imaging, vol. 18, no. 9, pp. 787–794, 1999.
- F. N. S Medeiros, N. D. A. Mascarenhas, R. C. P Marques, and C. M. Laprano, "Edge preserving wavelet speckle filtering," in 5th IEEE Southwest Symposium on Image Analysis and Interpretation, Santa Fe, NM, pp. 281–285, April 7–9, 2002, doi:10.1109/IAI.2002.999933.
- C. M. Sehgal, "Quantitative relationship between tissue composition and scattering of ultrasound", J. Acoust. Soc. Am. , vol. 94, No. 3, pp. 1944-1952, Oct. 1993.
- J. T. M. Verhoeven and J. M. Thijssen, "Improvement of lesion detectability by speckle reduction filtering: A quantitative study", Ultrason. Imag. , vol. 15, pp. 181-204, 1993.
- Paul Butler, "Applied Radiological Imaging for Medical Students", 1st Edition, Cambridge University Press, 2007.
- Rangaraj M. Rangayyan, "Biomedical Signal Analysis A Case study Approach", IEEE Press, 2005.
- Stephane Mallat, "A Wavelet Tour of signal Processing", Elsevier, 2006.
- D L Donoho and M. Jhonstone, "Wavelet shrinkage: Asymptopia? ", J. Roy. Stat. Soc. , SerB, Vol. 57, pp. 301-369, 1995.
- D L Donoho, "De-Noising by Soft-Thresholding", IEEE Transactions on Information Theory, vol. 41, No. 3, May 1995.
- David L. Donoho and Iain M. Johnstone. ,"Adapting to unknown smoothness via wavelet shrinkage", Journal of the American Statistical Association, vol. 90, no432, pp. 1200-1224, December 1995. National Laboratory, July 27, 2001.
- Ming Zhang and Bahadir K Guntuk, 'Multiresolution bilateral filtering for image denoising', IEEE Transactions on Image Processing, Vol. 17, No. 12, December 2008.
- S. G. Mallat and W. L. Hwang, "Singularity detection and processing with wavelets," IEEE Trans. Inform. Theory, vol. 38, pp. 617–643, Mar. 1992.
- I. Daubechies, "Ten Lectures on Wavelets", SIAM Publishers, 1992.
- Z. Wang, A. C. Bovik, H. R. Sheikh and E. P. Simoncelli, "Image quality assessment: From error visibility to structural similarity," IEEE Transactions on Image Processing, vol. 13, no. 4, pp. 600-612, Apr. 2004.
- R. Coifman and D. Donoho, "Translation invariant de-noising," in Lecture Notes in Statistics: Wavelets and Statistics, vol. New York: Springer-Verlag, pp. 125--150, 1995.
- I. W. Selesnick, "The double density dual tree DWT", IEEE Transactions on Signal Processing, Vol 52. No. 5, May 2004.

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