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MASTER'S THESIS

Denoising methods in ultrasound images via GUI

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ABSTRACT

The establishment of Ultrasonography (US) as a leading tool in the majority of medical applications worldwide, is directly associated with the evolution of imaging technology employed in medicine and biology. The design and implementation of novel and -state of the art- ultrasound systems, allowed US to infiltrate into medical applications.

Despite the profound advantages of ultrasonography, US images carry a granular pattern, so called speckle, which constitutes a major image quality degradation factor. Speckle pattern is created when an ultrasonic wave with uniform intensity is incident either on a rough surface or on tissue particles that are spaced at less than the axial resolving distance of the US system. In that case, the reflection beam profile will not have a uniform intensity. Instead it will be composed of many regions with strong and weak intensities. This complex intensity profile arises because sound is reflected in many different directions from the rough surface or from the small scatterers, thus leading US waves that have travelled different scan lines to interfere constructively and destructively towards the ultrasonic transducer. The intensity fluctuations within a uniform anatomic area, caused by the above phenomenon, constitute speckle. The resulting degraded by speckle US image does not correspond to the actual tissue microstructure. In fact, speckle noise deteriorates image quality, fine details and edge definition. Speckle also tends to mask the presence of low-contrast lesions, therefore reducing the physician's ability for accurate interpretation.

The methods will be studied and implemented through the graphic user interface using the multilevel transformation wavelets [1] [2]. The first method uses the statistical distribution of the coefficients of the transformation wavelets for removing noise speckle, while the second classifies each item as speckle or helpful information based on the properties of local maxima evaluated by the transformation wavelets.

For the effectiveness of methods various quantitative indices, will be evaluated for both superior speckle reduction performance and edge preservation properties.

SUBJECT AREA: Medical Informatics

KEYWORDS: Ultrasound Image, Speckle Noise Reduction, Wavelets, Local Maxima, Singularity Detection, Coarse to Fine, GUI.

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[2] S. Tsantis, N. Dimitropoulos, M. Ioannidou, D. Cavouras, and G. Nikiforidis, Inter-Scale Wavelet Analysis for Speckle Reduction in Thyroid Ultrasound Images, *Computerized Medical Imaging and Graphics*, vol. 31, no. 3, Apr. 2007, pp. 117-127.