# Despeckle Filtering Algorithms and Software for Ultrasound Imaging

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## ABSTRACT

It is well-known that speckle is a multiplicative noise that degrades image quality and the visual evaluation in ultrasound imaging. This necessitates the need for robust despeckling techniques for both routine clinical practice and teleconsultation. The goal for this book is to introduce the theoretical background (equations), the algorithmic steps, and the MATLAB™ code for the following group of despeckle filters: linear filtering, nonlinear filtering, anisotropic diffusion filtering and wavelet filtering. The book proposes a comparative evaluation framework of these despeckle filters based on texture analysis, image quality evaluation metrics, and visual evaluation by medical experts, in the assessment of cardiovascular ultrasound images recorded from the carotid artery. The results of our work presented in this book, suggest that the linear local statistics filter *DsFlsmv*, gave the best performance, followed by the nonlinear geometric filter *DsFgf4d*, and the linear homogeneous mask area filter *DsFlsminsc*. These filters improved the class separation between the asymptomatic and the symptomatic classes (of ultrasound images recorded from the carotid artery for the assessment of stroke) based on the statistics of the extracted texture features, gave only a marginal improvement in the classification success rate, and improved the visual assessment carried out by two medical experts. A despeckle filtering analysis and evaluation framework is proposed for selecting the most appropriate filter or filters for the images under investigation. These filters can be further developed and evaluated at a larger scale and in clinical practice in the automated image and video segmentation, texture analysis, and classification not only for medical ultrasound but for other modalities as well, such as synthetic aperture radar (SAR) images.



## KEYWORDS

Speckle, despeckle, noise filtering, ultrasound, ultrasound imaging, cardiovascular imaging, SAR, texture, image quality, carotid artery

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