

Analysis in Mathematical Models for Medical Ultrasound Image Noise

Nuttawut Jensakda^{†1} and Jessada Tanthanuch[‡],

[†]School of Mathematics, Institute of Science, Suranaree University of Technology,
Nakhon Ratchasima, 30000, Thailand
e-mail : jensakda@hotmail.co.th

[‡]School of Mathematics, Institute of Science, Suranaree University of Technology,
Nakhon Ratchasima, 30000, Thailand
e-mail : jessada@g.sut.ac.th

Abstract : Medical ultrasound imaging is one of the important non-destructive techniques for diagnosis. Speckle noise is a major problem degrading image quality. The existing techniques of noise reduction usually derive the parameters for quality optimization from the image as a whole.

This article first presents three mathematical models of speckle noise probability distributions. Then a new model of image noise reduction is proposed. For a given noisy image, varied parameters and distributions referenced from type and position of tissues are estimated and used to denoise. Finally, a comparison of reconstructed images is presented.

Keywords : speckle reduction, variational method, medical ultrasound image, image processing
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1 Introduction

Ultrasound denotes sound waves of frequencies higher than the upper audible limit of human hearing. It is considered as a mechanical disturbance that moves as a pressure wave through a medium. In medical diagnosis, ultrasound echo signals are used: an image of soft tissue in a body can be produced by transforming the ultrasound echo signals received to electricity voltage and then processing the detected voltage to the brightness at each point of the image.

However, there are many types of noise which contribute to the reduction of the quality of a medical ultrasound image. Generally, noise patterns in ultrasound images are considered as noises generated from two sources. One arises from noise generated by electronic devices (electrical noise). The other one arises from noise-like variation called speckle (noise). In practice,

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¹Corresponding author email: jensakda@hotmail.co.th (Nuttawut Jensakda)