Effect of Depth on Texture Features of Ultrasound Images

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Abstract : In diagnostic ultrasound, the echo graphic B-scan texture is an important area of investigation since it can be analyzed to characterize the histological state of internal tissues. An important factor requiring consideration when evaluating ultrasonic tissue texture is the depth. The effect of attenuation with depth of ultrasound, the size of the region of interest, gain, and dynamic range are important variables to consider as they can influence the analysis of texture features. These sources of variability have to be considered carefully when evaluating image texture as different settings might influence the resultant image. The aim of this study is to investigate the effect of depth on the texture features in-vivo using a 3D ultrasound probe. The left leg medial head of the gastrocnemius muscle of 10 healthy subjects were scanned. Two regions A and B were defined at different depth within the gastrocnemius muscle boundary. The size of both ROI's was 280*20 pixels and the distance between region A and B was kept constant at 5 mm. Texture parameters include gray level, variance, skewness, kurtosis, co-occurrence matrix; run length matrix, gradient, autoregressive (AR) model and wavelet transform were extracted from the images. The paired t –test was used to test the depth effect for the normally distributed data and the Wilcoxon–Mann-Whitney test was used for the non-normally distributed data. The gray level, variance, and run length matrix were significantly lowered when the depth increased. The other texture parameters showed similar values at different depth. All the texture parameters showed no significant difference between depths A and B ($p > 0.05$) except for gray level, variance and run length matrix ($p < 0.05$). This indicates that gray level, variance, and run length matrix are depth dependent.

Keywords : ultrasound image, texture parameters, computational biology, biomedical engineering

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