

**Title:** Multiscale Texture Analysis for Determination of Likelihood of Malignancy on Focal Liver Lesions in Sonograms

Accurate sonographic characterization of focal liver lesions can reduce the number of unnecessary, expensive imaging (CT, MRI, and scintigraphy) or avoid a biopsy. The purpose of this study is to distinguish between benign and malignant lesions in ultrasound images based on multiscale texture analysis using wavelet packets. In this method, ROIs extracted from within the lesions are decomposed into subimages by wavelet packets. Multiscale texture features are calculated from these subimages based upon a single-scale feature defined on the original ROIs. An artificial neural network (ANN) is used for combining these multiscale features for classification of lesions, and its performance is measured by the area under the ROC curve ( $A_z$ ). A subset of the multiscale features that yields the highest performance is selected in a step-wise manner as the wavelet packet decomposition is performed. Three single-scale features, i.e., entropy, root mean square, and first moment of the power spectrum, are used to generate the multiscale texture features. In an analysis of 193 ROIs consisting of 50 hemangiomas (benign lesions), 69 hepatocellular carcinomas, and 74 metastases (both malignant lesions), the multiscale features yielded a high  $A_z$  value of 0.92 in distinguishing benign from malignant lesions, whereas the single-scale features yielded only 0.70. Our multiscale texture analysis method provides accurate differentiation between malignant and benign lesions, and thus can increase the accuracy of diagnosis of focal liver lesions in sonography.

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