We developed methods for automated characterization of breast lesions using contrast-enhanced magnetic resonance images (MRI). The aim of this study is to assess the efficacy of spatial and temporal characteristics to distinguish between malignant and benign lesions.

Our database consists of 28 lesions: 15 malignant, 13 benign. After injection of Gd-DTPA, 3-D MR data are acquired in at least 4 time frames of 90 s. The lesions are characterized by 7 spatial features, quantifying the inhomogeneity, shape, and sharpness (e.g., 'margin gradient') of contrast uptake over time. Linear discrimant analysis, step-wise multiple regression, cross-validation and ROC analysis are employed to estimate the likelihood of malignancy and performance. The methods are employed in 3-D and 2-D (single and multiple slices), using all time frames and single frames.

Shape and sharpness were consistently the most effective features. The best performance was obtained in 3-D using all time frames (A_z=0.96). Analysis in 2-D yielded varying performance (A_z as low as 0.67), occasionally significantly lower than that obtained by 3-D (p=0.005). The 'margin gradient' feature yielded a significant increase (p=0.013) in performance in 3-D during the first 270 s (A_z from 0.65 to 0.85). Multi-frame analysis yielded performance comparable to that obtained from the optimal frame.

The performance of 2-D analysis varies, and may be significantly lower than that of 3-D analysis. Using the given protocol, it is advisable to quantify margin sharpness related features in not just the first time frame.

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