Purpose: To extend CADx techniques for High Spectral and Spatial Resolution (HiSS) breast MRI, and to assess the ability of the Lorentzian-fit-subtraction residual maxima of the water resonance spectra to distinguish between benign and malignant breast lesions on a voxel-by-voxel basis.

Methods: HiSS high resolution spectroscopic MR images were collected under an IRB-approved protocol. To analyze HiSS data, we fit a Lorentzian curve to a 25 bin (140 Hz) region of the proton-resonance spectra in each lesion, centered at the water resonance and normalized to the water peak height. After subtracting this fit from each spectrum, the maximum residual value in nine spectral bins from +22.4 to +67.2 Hz to the right of the water peak was recorded with its corresponding frequency bin. We automatically excluded voxels in each lesion with maximum residual lower than 60% of the maximum residual in the entire lesion in order to eliminate voxels with off-peaks close to or below the noise floor. These residual maxima were evaluated on a voxel-by-voxel basis, for each frequency bin based on the known diagnosis (9 malignant; 8 benign cases) and the performance of this single feature was assessed using ROC analysis.

Results: In the task of distinguishing between voxels in malignant and benign lesions, analysis across all nine spectral bins yielded an AUC value of 0.96 ± 0.007. AUC values within specific spectral bins ranged from 0.72 at 5.6 Hz from the water peak to 1.0 at 60.6 Hz - noting that the latter could be artificially high due to our limited database.

Conclusions: We have presented a technique utilizing a voxel-based approach to HiSS spectral analysis, with potential for use in the diagnosis of cancerous breast lesions. We are currently extending this method to include lesion-based classification rather than voxel-based evaluation.

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M.L. Giger is a stockholder in R2 Technology/Hologic, has equity in Quantitative Insights, and receives royalties from Hologic, GE Medical Systems, MEDIAN Technologies, Riverain Medical, Mitsubishi and Toshiba. G.S. Karczmar has an institutional research agreement with Philips Healthcare. It is the University of Chicago Conflict of Interest Policy that investigators disclose publicly actual or potential significant financial interest that would reasonably appear to be directly and significantly affected by the research activities.