

AbstractID: 12690 Title: Fractal Dimension Analysis of Kinetic Feature Maps in Contrast-Enhanced Breast MRI

Purpose: To investigate whether CADx performance on breast DCE-MRI can be improved by estimating the spatial complexity of lesion kinetic feature maps using generalized fractal dimension lesion descriptors (FDLDs). **Method and Materials:** A database of 181 histologically classified breast lesions visible on DCE-MRI was analyzed as follows. Initially, each lesion was segmented from the parenchyma using a previously developed and validated fuzzy C-means clustering technique. A kinetic curve was obtained from each lesion voxel, and kinetic features were extracted from each kinetic curve. These features were used to generate 3-D kinetic feature maps for each lesion, and generalized FDLDs were calculated for each kinetic feature map. The diagnostic efficacy of the individual FDLDs was then evaluated using ROC analysis. Next, to explore whether the FDLDs could improve the performance of previous CAD_x methods, a conventional set of kinetic and morphological lesion features was compared with a feature set containing conventional features *and* FDLDs. Each feature set was merged using linear discriminant analysis (LDA) and evaluated using ROC analysis, together with a leave-one-case-out method to minimize database bias. Finally, the area under the ROC curve (A_z) values of the two feature sets were statistically compared using ROCKIT software. **Results:** The individual FDLDs obtained a maximum performance of $A_z = 0.85 \pm 0.03$. The conventional features achieved $A_z = 0.87 \pm 0.03$, and the FDLDs combined with conventional features gave $A_z = 0.90 \pm 0.02$. The A_z value of the conventional features *and* FDLDs was significantly higher than the A_z value of the conventional features alone ($p = 0.023$). **Conclusion:** The work suggests that generalized FDLDs could potentially be beneficial to a clinical CADx system for breast DCE-MRI in the future. **Conflict of Interest:** Stockholder: R2 Technology/Hologic; royalties: Hologic, GE Medical Systems, MEDIAN Technologies, Riverain Medical, Mitsubishi and Toshiba.