

Purpose: To develop a computerized lesion detection method for DCE-MRI breast images using the fuzzy c-means clustering algorithm.

Method: Contrast-enhanced MR imaging is increasingly being incorporated into procedures for the screening of women at high risk of developing breast cancer. Such screening programs may potentially benefit from computer prompts that indicate potential lesion sites. In addition, analysis of other enhancing regions in the breast may reduce the number of false detections. Thus, we are developing an automated computerized lesion detection method based on the fuzzy c-means clustering algorithm. The proposed method consists of four stages: (1) Breast volume segmentation based on a volume growing method ; (2) Fuzzy c-means clustering analysis on voxel-based kinetics within the 4D breast image data (3D over time); (3) Voxel-by-voxel membership assignment to the most-enhancing categories; and (4) Connectivity & size criteria for eliminating some false-positive detections. Methods were evaluated by calculating detection sensitivity for malignant lesions, detection sensitivity for all lesions, and number of false-positive detections per breast volume for output from the most-enhancing kinetic categories.

Results: Our preliminary studies are based on 20 MRI cases including 21 lesions (9 biopsy-proven malignant cases, 5 biopsy-proven benign cases; 6 cases without pathological proof). Based on computer-identified regions from the most enhancing membership category, the proposed method correctly detected 16 lesions, including all nine malignant ones. In addition, most of the benign cases fell into either the most-enhancing or second-most-enhancing categories. Preliminary results yielded, on average, 9 false-positive detections per breast volume, which will subsequently be input to the classifier stage that exams morphological and kinetic characteristics for false positive reduction.

Conclusion: The preliminary results with our FCM-based computerized MRI lesion detection method are promising for potential use in breast cancer screening.

Conflict of Interest: M.L.G. is a shareholder in R2 Technology, Inc.