Purpose:

Preliminary analysis shows that breast fibroglandular tissue (FGT) ratio and background parenchymal enhancement (BPE) of magnetic resonance (MR) imaging are predictive of future breast cancer risk.

Adequate methods for automatic/semi-automatic breast and chest wall segmentation, and FGT histogram extraction and analysis were not available.

Methods:

This method is tested on the retrospective HIPAA-compliant study, which includes 1275 women who underwent breast MR imaging between December 2002 and February 2008.

The method works in user-directed stages for each image slice:

1. A straight-line and ellipse Hough transform are applied to detect chest wall boundaries and separate out the chest region if it is present.

2. Edge detection and morphology tools are deployed to segment out the breast region. Human input is required to justify and adjust the segmentation result.

3. Typical breast MRI histograms have double peaks, of fat regions and FGT content inside the segmented breast. Human input is needed here to justify and select a proper segmentation threshold value for whole breast FGT segmentation.

Interactive GUIs were developed in Matlab for all the human input sections.

Results:

Various chest wall boundary lines are detected by Hough transform. Breast region is segmented out either automatically by the morphology tools or redefined by researchers if there is no proper boundaries available in the MR images. Breast region is analyzed by histogram technology to separate FGT from fat.
Conclusions:

We have developed a semi-automatic human-guided breast segmentation method for MRI based on Hough transform, morphology tools and histogram technology. This approach enables novel breast segmentation and analysis.