Focal Asymmetry and Laterality of Cancer

Faraz Janan [1], Sir Michael Brady FRS FREng, FMedSci [2]
1. University of Lincoln; 2. University of Oxford

Background

BIRADS score for mammographic densities does not indicate which of the asymmetric bilateral breast has a higher density, and could be at a higher risk of developing (or having) cancer. Focal density ('developing') is a region that has recently appeared on a mammogram, it is present in both CC and MLO views, but could be seen in only one of the breasts. Using focal density (FD) quantification we assign a density score to each of the bilateral breast to assess breast asymmetry.

Methods

Our method, which is a substantial improvement on our previous method (RICE) [1], suppresses normal breast parenchyma and highlights ROIs (see Figure 1) in mammographic images. It embodies a simple but realistic assumption that the neighborhood typically has a similar tissue density to that of the tissue encompassing the candidate masked tumor. The method was applied to 11 patient cases of highly dense mammograms with cancers. Our method produced a density score for each individual breast and determine the asymmetry percentage.

Results

Out of 12 patient cases, except for a single instance, all asymmetric FD scores suggest the laterality of cancer. All mammograms were pre-processed with Volpara breast density quantification software [2]. It is observed that in some cases where the volumetric density grade percentage VGD% is very similar for the left and right breast, our method effectively produces distinct FD scores confirming to the laterality of cancer.

Conclusions

We assessed asymmetric FD in bilateral mammograms using a method based on the actual composition of the breast. In initial experiments, our method shows a promising potential for quantifying breast asymmetry with respect to the laterality of cancer. It works very well in all BIRADS classes, including BIRADS-D.

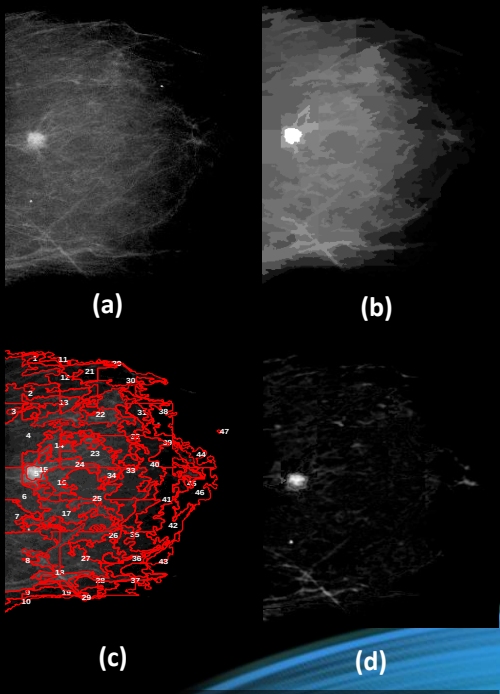

Figure. 1. (a) A mammographic density map; (b) piecewise constant estimation (superpixels) generated by iterative clustering ; (c) segmented texture-based regions/components of the breast; (4) normal parenchyma suppressed while focal densities (in this case a visible mass) highlighted.

[1] F. Janan, M. Brady, R. H.-P. MICCAI-BIA, and 2015, "RICE: Region of Interest …Maps," 2015.

[2] R. Highnam, M. Brady, M. J. Yaffe, N. K.-… workshop on digital …, and 2010, "Robust breast composition measurement-VolparaTM," 2010.