Understanding the impact of local texture features on search and localization in digital breast imaging

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RATIONALE:

The notions of image quality and appearance are essential to the assessment of medical imaging techniques and systems. In the field of perception especially, these concepts attract much discussion because of their influence on observer performance. Though texture features extracted from medical images have previously been correlated with risk in various studies, the impacts of texture features on search and localization in these images have yet to be rigorously probed. In this study, we will investigate the effects of both changes in breast properties and changes in acquisition and reconstruction parameters on image texture. Furthermore, by comparing these texture descriptors with changes in human observer LROC with respect to the same parameters, we hope to shed some light on the impact of certain acquisition geometries and reconstruction parameters on detection.

METHODS:

A serial cascade model for image generation was utilized to create some 6,000 simulated DBT images of the phantoms provided by Bakic et al. from the University of Pennsylvania. These images were reconstructed for a variety of DBT and phantom parameters such as angular span, number of projections, and breast density. Thirteen texture features were calculated for randomly selected 100x100 pixel ROIs within the fibroglandular tissue of all images. Additionally, a human observer LROC study was conducted for images of 60º span, a combination of all densities, and varying number of projections.

RESULTS:

Four of the thirteen texture features show strong correlation with the area under the LROC curve (correlation coefficient > 0.75) when both are plotted against the number of projections used in image reconstruction. Moreover, these four texture parameters exhibit significant changes when acquisition, reconstruction, and phantom parameters were altered.

CONCLUSIONS:

Based on the trends of the texture descriptors, there does indeed appear to be some relationship between human observer LROC data and the texture of images used in the studies. Furthermore, it is clear that DBT parameters as well as breast density impact the texture of images significantly.