AbstractID: 3587 Title: Dual-energy digital mammography for calcification imaging: improvement by image processing

Purpose: We have developed and implemented a full-field dual-energy digital mammography (DEDM) technique, with total mean-glandular dose similar to screening-examination levels, to detect and visualize calcifications over tissue structures on mammograms. The suppression of tissue structures by DEDM comes at the cost of increased DE image noise. We report on the effects of image processing techniques on the DE calcification images.

Materials and Methods: To evaluate different image processing techniques, we have designed a special phantom with calcium carbonate crystals simulating calcifications of various sizes superimposed with a 5 cm thick breast-tissue phantom with continuously varying glandular ratio from 0.0 to 1.0. We report on the effects of three noise reduction techniques: (1) a simple smoothing filter applied to the DE image, (2) a median filter applied to the HE image, and (3) a correlated-noise reduction technique (KNR), where the scaled correlated noise from the DE tissue image was added to the DE calcification image (originally developed for DE computed tomography by Kalender et al., IEEE Transactions on Medical Physics 7, 218, 1988).

Results: Most calcifications larger than 355 microns were visible in the unprocessed DE calcification image. The simple smoothing filter, although effective in noise suppression, does not improve calcification visibility due to loss of spatial resolution. Calcifications larger than 300 microns were visible with the median filter for kernel sizes of 3 and 5 pixels; while calcifications larger than 250 microns were visible with the the KNR technique for a scale facor of 0.00145 and kernal sizes of 25 and 51 pixels.

Conclusions: The median and KNR image processing techniques improved calcification visibility while reducing the image noise in the DE calcification images.

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