AbstractID: 14031 Title: Reducing Dose in Breast Tomosynthesis using Bayesian Image Estimation

Purpose: To reduce dose of breast tomosynthesis imaging by applying Bayesian Image Estimation (BIE) processing to projection images. BIE has been shown previously to reduce scatter and improve image signal-to-noise ratios without an associated loss of resolution.

Methods & Materials: A mammography QA phantom (CIRS model 011A) was imaged on a prototype Siemens breast tomosynthesis system. Projection images were processed with BIE, which is an iterative, statistical processing technique that estimates and removes radiographic noise and scatter. To assess image quality, line pair and mass-like objects were digitally embedded at varying levels of contrast. A grid search over the four free parameters of the algorithm (full-width half-maximum, Gibbs beta multiplier, scatter-to-primary ratio, and iteration number) was conducted to optimize signal-difference-to-noise ratio (SdNR) of those line pairs and masses. The optimized, processed images were reconstructed using the Siemens filtered backprojection algorithm.

Results: Resolution (measured by SdNR of line pairs) was consistently preserved for ½ and ¼ Nyquist frequencies and/or targets with at least medium (≥3%) contrast. These correspond well to parenchyma that tends to be low-frequency and medium-contrast as well as calcifications which are high-frequency and high-contrast. For simulated masses, SdNR was consistently improved up to 4-fold. Reconstructed images showed qualitative improvements in lesion conspicuity for masses, fibers, and calcifications.

Conclusion: BIE processing demonstrated improved lesion conspicuity while maintaining resolution in tomosynthesis projection images. On-going work will explore trading off this image quality improvement for reduced dose. Specifically, low-dose (50% or lower) images will be processed with BIE to yield the same image quality as a regular-dose acquisition. Low-dose tomosynthesis is clinically significant given the likelihood of requiring two scans per breast for screening and even more scans for diagnostic exams, contrast imaging, or biopsy guidance.

Conflict of interest statement: Research sponsored in part by Siemens Healthcare.