Purpose: The role of breast density in cancer detection has been well characterized, and newer modalities such as breast tomosynthesis and breast CT (bCT) were developed to improve cancer detection in the dense breast by reducing anatomical complexity. Anatomical noise was characterized on a small cohort of patient images and compared across digital mammography, tomosynthesis, and bCT images. Methods and Materials: An IRB-approved and HIPPA-compliant clinical study was performed on women undergoing breast biopsy, and mammography, tomosynthesis, and bCT were performed on both breasts immediately prior to biopsy. A total of 23 women participated in this study, and the unaffected breast (no lesion) was evaluated. A total of 1000 regions of interest were sampled on each image data set, and the 2D noise power spectrum (NPS) was evaluated. This was radially averaged to produce a 1D NPS, and the NPS was fit to a power law: \( \ln\{NPS(f)\} = \alpha + \beta \ln(f) \), over an anatomically-relevant range of spatial frequencies. The slope, beta, was averaged across patients and compared between modalities and projections. Results: The value of beta was determined for bCT data sets, and they were 1.75 (0.424), 1.83 (0.352), and 1.79 (0.397), for the coronal, sagittal and axial views, respectively. For tomosynthesis, beta was 3.06 (0.361) and 3.10 (0.315) for the CC and MLO views, respectively. For mammography, these values were 3.17 (0.226) and 3.30 (0.236), for the CC and MLO views, respectively. The values of beta for breast CT were significantly different than those for tomosynthesis and mammography (p<0.001, all 12 comparisons). Conclusions: The results of this investigation demonstrate that the anatomical complexity of the breast, as characterized by the parameter beta, is statistically similar between mammography and tomosynthesis, a somewhat surprising finding. The breast CT image data, however, demonstrate a statistically-significant reduction in beta across all projections.

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