

AbstractID: 7707 Title: Image Registration for Change Detection and Quantification in Multimodality Breast Tomosynthesis and Ultrasound

Purpose: To evaluate tomosynthesis-to-tomosynthesis and ultrasound-to-ultrasound image based registration (IBaR) of whole breast image volumes acquired at different times. These two modalities are probably the most immediately promising for routine breast cancer screening and diagnosis. Successful IBaR should aid more rapid and detailed detection of change in response to treatment or tumor growth over time.

Method and Materials: A system combining automated whole breast ultrasound (ABU) and digital tomosynthesis mammography (DTM) is being utilized in several studies of breast mass classification and assessment of response to neoadjuvant chemotherapy. Much attention was given to making the breast stable for the duration of each exam with the breast compressed between mammographic-style plates and with acoustic coupling for reproducible, large area scanning through the plates. Four DTM pairs and many ABU pairs were acquired after reasonable stability and coverage techniques were developed. Registration was performed with MIAMI Fuse™ nonrigid registration based on the mutual information cost function and thin plate spline interpolation.

Results: Registration was successful on 5 of 8 recent ABU image volume pairs with a mean registration error (MRE) of 3 ± 2 mm and on all 4 DTM pairs, $MRE = 4 \pm 2$ mm, as determined from visually selected homologous points. The lowest DTM mean error was obtained from studies 1 year apart, with minimal change in the breast.

Conclusion: Both ABU and DTM offer angle dependent artifacts, with registration being perhaps more difficult in ABU. The variable breast distortion during compression offers similar difficulties, probably greater than actual breast change. No special effort was directed toward reproducible positioning. These results suggest that, usually, it should be possible to display in the same slice of two separate studies, a breast mass of > 5 mm, or its preceding tissues.

Conflict of Interest: Work performed in cooperation with xxx, Inc.