AbstractID: 7418 Title: 3D Computer-aided Detection of Masses and Micro-calcifications from Cone Beam CT Scans: A Breast Phantom Study

Purpose:
Cone Beam Breast Computed Tomography (CBBCT) has emerged as a promising new modality for detection and diagnosis of breast cancer. Compared to conventional X-ray mammography, CBBCT provides much greater detail of breast tissue in three-dimensions (3D) as well as improved patient comfort. However, these benefits come at the cost of hundreds of image slices for each scan. Here, a validation study was performed using CBBCT data of a breast phantom with known nodules and micro-calcifications. A novel 3D computer-aided detection algorithm based on 3D template-matching was applied to this dataset to evaluate the performance of CAD-CBBCT.

Method and Materials:
The CBBCT dataset of the breast phantom consisted of 371 slices with isotropic resolution of 0.27 mm. The central 250 contiguous slices were used in our analysis. The selected imaging volume contained 8 masses with diameter ranging from 0.5-10mm (appearing on 9-37 pixels), and 13 micro-calcifications with diameter ranging from 0.2-0.5 mm (appearing on 3-5 pixels). Our CAD algorithm models masses and micro-calcifications as spheres (templates) of varying sizes and searches for structures similar to the templates throughout the entire imaging volume. Templates of 9 different sizes were applied. The end result is a single index (the normalized cross correlation coefficient) for each mass and calcification candidate. An optimal correlation threshold for each template size was then selected to best identify the nodules and micro-calcifications.

Results:
8 out of 8 masses down to 0.5 mm and 12 out of 13 micro-calcifications down to 0.2 mm were successfully detected, with only 1 false positive finding. The processing time for each template was ~80 seconds (on a Mac Pro with 2.66GHz CPU, 5G memory).

Conclusion:
CBBCT and 3D CAD were able to detect in a breast imaging phantom very small nodules and micro-calcifications with high sensitivity and specificity.