

**Purpose:** To validate and compare methods for breast tissue segmentation using a new approach based on supine and prone computed tomography data.

**Method and Materials:** The breast was segmented into fibroglandular and fatty tissue for 24 patients, who had CT scans in both supine and prone position on the same day. The segmentation methods explored were: physical density thresholding; two compartment model; interactive thresholding; fuzzy c-means clustering (FCM) with different thresholds; and k-means clustering. Firstly, validation was based on the assumption that the breast composition is the same for supine and prone CT. Volumetric breast density (VBD, proportion of breast composed of fibroglandular tissue) of supine and prone scans and its relative difference (RDVBD) were calculated. Expert outlining was used for further validation using the Dice similarity coefficient (DSC). Analysis of variance (ANOVA) followed by post-hoc comparisons (Bonferroni,  $p < 0.05$ ) was used to determine statistical differences between the methods.

**Results:** Mean RDVBDs were 21% (physical density thresholding); 13% (interactive thresholding); 11% (two compartment model); 8%-17% (FCM); and 10% (kmeans). Minimum mean RDVBD was 8%, for FCM with three classes (FCM3) thresholded at 0.10 and 0.20. However, ANOVA on RDVBD did not indicate significant differences ( $p = 0.13$ ) between the methods. For all FCM, FCM3 thresholded at 0.20 generates segmentation closest to experts' delineation. Mean DSCs were 0.74 (interactive thresholding); 0.80 (FCM3 at 0.20); 0.75 (k-means). ANOVA on DSCs indicated that there were significant differences ( $p < 0.05$ ), post-hoc analysis (Bonferroni,  $p < 0.05$ ) revealed that the FCM3 method was significantly better than interactive thresholding.

**Conclusions:** FCM3 thresholded at 0.20 gives most accurate segmentation of breast tissue from CT data. This study demonstrated a first attempt at using validation based on supine and prone scan. Results indicate differences between them. Understanding these differences is the subject of ongoing investigation.