Three-dimensional breast volume assessment

Gouveia P, Monteiro JP, Oliveira HP, Cardoso MJ, Cardoso JS
Champalimaud Clinical Center, Breast Unit, Lisbon, Portugal
INESC TEC, Porto, Portugal

Breast volume quantification is essential for breast cancer surgery planning. Several methods have been described for breast volume assessment. Breast magnetic resonance imaging (MRI) is considered the gold standard for breast size measurements. However, MRI is not routinely used for breast cancer diagnosis, implying additional costs if used for this purpose. Three-dimensional (3D) imaging of the breast has provided reproducible and clinically valid data for volume evaluation, however, available 3D solutions are still very expensive.

Estimate breast volume using a reconstructed 3D model based on 2.5D images captured with a low cost surface scan device.

3D reconstructed models of breasts from 2.5D images captured with the Microsoft® Kinect device from 15 patients with early breast cancer before surgery were included. MRI scans were identically performed in all patients before surgery. For each method, breast volumes were computed using a convex hull approach. The agreement between the volumes obtained with both methods was assessed with Spearman, Kendall's tau and Pearson's linear correlation coefficients.

Pearson's linear correlation coefficient was 0.90, the Kendall rank correlation coefficient was 0.64, while the Spearman coefficient was 0.81. The average difference between volumes from both methods was 200 cc.

The direct comparison between breast volumes in each modality is not clear because it is difficult to identify the exact position of the chest wall. Since the Spearman coefficient, Kendall's tau and Pearson's coefficient are high, this indicates that the relationship is monotonic. Although the values obtained by both methodologies still differ, the strong linear correlation coefficient suggests that improvements in the chest wall estimation may bring the results closer. Beyond rear demarcation, breast boundaries delimitation are somehow different when using each method, and variability increases with less anatomically defined landmarks.