

Developing a Clinically Reliable Assessment Model for Breast Appearance Following Breast Cancer Surgery and Radiotherapy: Feasibility Study

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Background

Breast-conserving surgery (BCS) and radiotherapy are the cornerstone treatment for breast cancer. However, adverse outcomes, most notably breast atrophy (shrinkage), can result following breast cancer treatment. Breast atrophy is the most common post-treatment late normal-tissue toxicity, accounting for 13% of grade ≥ 2 CTCAE even with modern treatment regimens.¹

Current methods for assessing breast atrophy often rely on subjective judgement by clinicians using unexplainable compound scores, like BCCT.core², or require expensive technologies like 3D scanners, which limit their practicality and reliability in clinical settings.

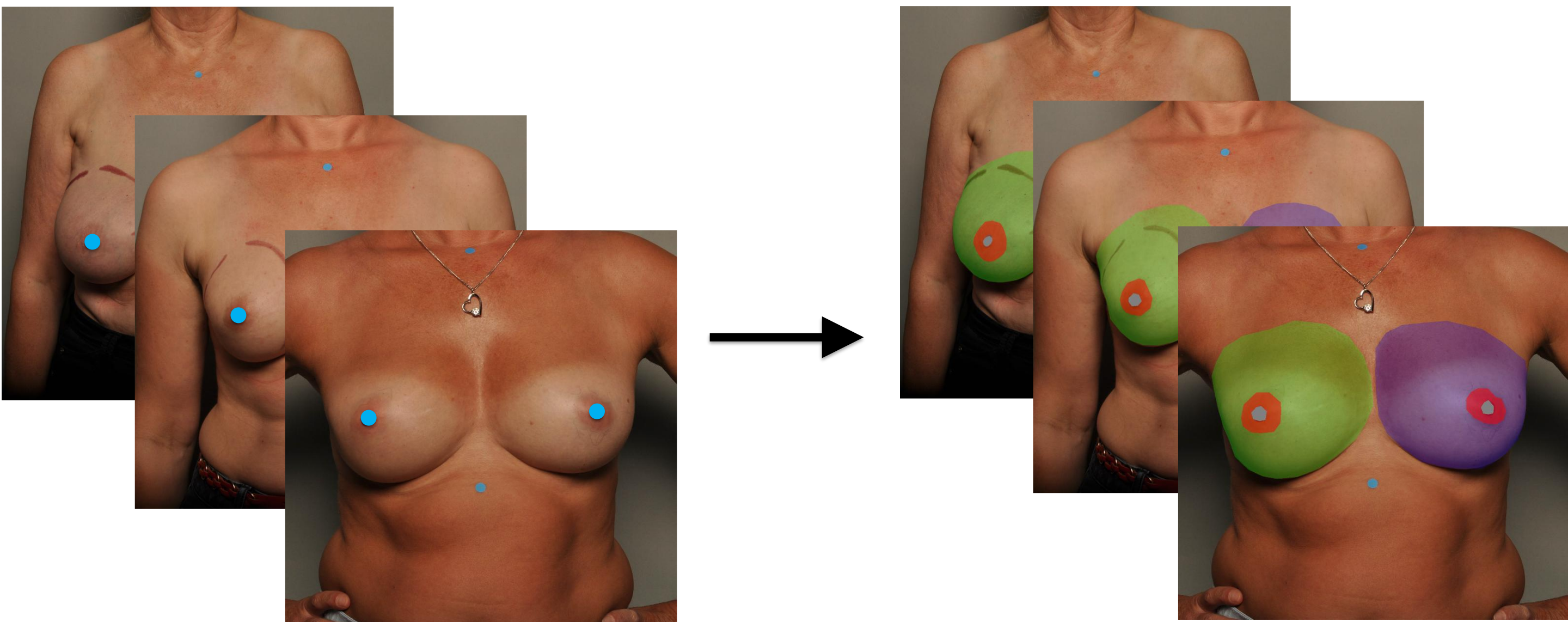
Study aim

This study aims to develop an objective, user friendly, open-source, machine-learning based, and affordable tool of quantifying breast volume and atrophy, which supports better everyday clinical practice.

Methods

- This prospective, observational, feasibility study recruits 100 early-stage breast cancer patients. Standardised 3D breast images will be acquired before and after treatment using an iPhone LiDAR app and a professional 3D camera, for non-inferiority comparison.
- A YOLO-v8 based breast landmark detection model, trained on over 8,000 annotated images from the REQUITE study dataset (www.requite.eu), segments breast regions from multiple mesh renders (Figure 1).
- These segmentations are integrated into a 3D mesh-processing pipeline for volume quantification and atrophy assessment.
- Model performance and clinical feasibility to be evaluated against ground-truth anthropometric measurements using breast castable moulds. Measurements are repeated twice and then averaged.

Results



precision(M)	recall(M)	mAP50(M)	mAP50-95(M)
0.96202	0.94492	0.96226	0.67561

Figure 1: Photos from the REQUITE Dataset and their manually outlined annotations used for retraining of baseline object detection model, *i.e.* YOLO-v8. The table under the images show high performance metrics after 150 training epochs. Precision: % of detections that are correct. Recall: % of true objects detected. mAP50: accuracy at 50% overlap (lenient). mAP50-95: accuracy over 50–95% overlap (strict).

References

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