

A Comparison of Different Approaches to Image Quality Assessment in Phase-Contrast Mammography

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Propagation-based phase-contrast computed tomography (PB-CT) has the potential to improve breast cancer detection and characterisation compared to established mammography techniques. The aim of this work is to find a quantitative image quality metric which could accurately predict the subjective clinical image quality assessment of PB-CT images made by radiologists as described in Taba et al. [1].

The experimental data analysed in this study included PB-CT scans, which were obtained for 12 full intact mastectomy samples at Imaging and Medical beamline (IMBL) of the Australian Synchrotron at different monochromatic X-ray energies and clinically relevant radiation doses. Quantitative image quality metrics, including visibility, signal to noise ratio (SNR), and spatial resolution, were calculated for all PB-CT and conventional CT image sets using the open-source 3D Slicer (<https://www.slicer.org/>) software. For each metric, an objective image quality “score” was generated to match the subjective scoring provided by the radiologists. Weighting factors were then applied to the scores and a weighted contrast to noise to resolution (CNR/res) score was calculated.

The unscaled contrast and spatial resolution scores were both found to have a significant correlation with the radiologists’ scores with R values of 0.9223 and 0.8360 respectively, while SNR had an insignificant correlation, with an R value of -0.6785. The weighted CNR/res score showed a significant correlation to the radiologists’ scores with an R value of 0.9681.

[1] S. T. Taba et al., *Academic radiology* 28.1 (2021): e20-e26.