Abstract 15:1-1

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Multi-modal breast MRI image analysis: Computer aided detection/ diagnosis of breast cancer

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Background: Computer-assisted detection/diagnosis (CAD) systems for breast MRI presently fall short of automatically locating and classifying malignant lesions. Instead they automate many of the image processing and analysis functions that would otherwise have to be performed manually and visualise the data to aid interpretation. A recent meta-study concluded that "CAD in breast MRI has little influence on the sensitivity and specificity of experienced radiologists and therefore their interpretation remains essential".

Purpose: A recent review of breast MRI and MRS concluded that breast MRI CAD needs to be based on "quantitative features extracted preferably from the automatically segmented 3D lesion" and a more comprehensive assessment of lesions based on features "derived from MR multi-parametric acquisitions". To this end MedTech West is collaborating with MedTeQ at the University of Queensland, CBA at Uppsala University, and Queensland X-Ray to develop novel CAD techniques to improve the sensitivity and specificity of breast MRI, and concomitantly its clinical utility.

Method: Our approach is based on combining multi-modal MRI with novel multi-parametric and multi-dimensional image analysis techniques. In particular we are developing methods to quantitatively characterise tissue morphology, microvasculature, and microstructure from spatially aligned multi-modal MR images including anatomical T1- and T2-weighted images, as well as images acquired using DCE-MRI (perfusion imaging), and diffusion-weighted imaging. We are also developing image analysis methods to automatically extract these features, segment (delineate) suspicious tissue, and classify the tissue as benign or malignant.

Results: Results to date include a novel registration evaluation framework based on a biomechanical breast model that permits realistic simulation of tissue deformation, new spatiotemporal features for improved discrimination of benign and malignant lesions in DCE-MRI, and most recently the first fully automatic method for breast lesion detection and delineation.

Conclusion: Our results demonstrate that improvements in the accuracy of breast MRI CAD are possible using multi-modal MRI coupled with multi-parametric and multi-dimensional image analysis techniques.