QUSTom: Quantitative Ultrasound Stochastic Tomography - Revolutionizing breast cancer diagnosis and screening with

Description

Ultrasound imaging can be deeply enhanced by means of algorithms developed in the field of geophysical imaging. Such algorithms, based upon adjoint-state modelling and iterative optimization, provide quantitative images of human tissue with very high resolution. At present time, suchimages can only be attained by means of high-performance computing and using specific ultrasound data acquisition devices. When combined, hardware and software have a huge impact potential for soft-tissue imaging, such as in breast cancer imaging. Nevertheless, and as is customaryin medical imaging, the obtained images only provide with the mean, or most likely, values of tissue at each pixel, being uncertainty quantificationan extremely expensive process, typically deemed as unfeasible for practical purposes. A revolutionary development in adjoint-based ultrasound imaging allows us to potentially obtain images of uncertainties at the cost of a single, mean-value, image. Such development will be the basis of transformative implications in terms of confidence-estimates for diagnosis. We aim atdisrupting the breast cancer screening paradigm by means of a safe (radiation-free), accurate (quantitative) and reliable (uncertainty-aware) novelbreast imaging modality.

Within QUSTom we will investigate the fundamental science behind adjoint-based uncertainty imaging and establish its potential suitability forbreast cancer diagnosis. The feasibility of the technology as a diagnosis tool relies on 1) adapting the data acquisition hardware for optimalresolution, 2) implementing the algorithms in high-performance computers in order to obtain a short time-to-solution and 3) feasibility analysis byexpert radiologists in comparison with the state-of-the-art in breast imaging. This proposal covers the three aspects and opens the possibility of applying similar principles in other imaging fields, both in medicine and elsewhere.

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