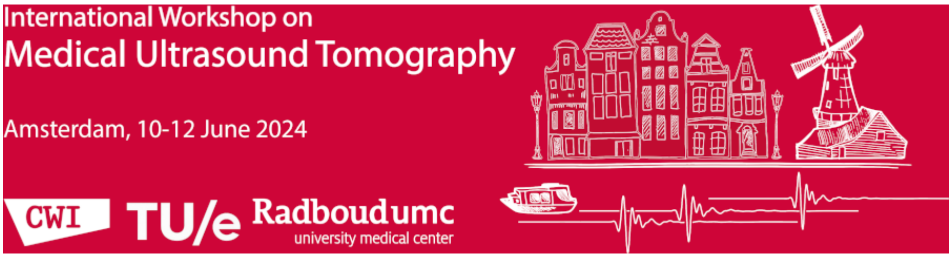

Contribution ID: **33**

Type: **not specified**

Uncertainty Estimation in Breast Multiparameter Full Waveform Inversion

Tuesday, June 11, 2024 2:40 PM (20 minutes)

Full waveform inversion (FWI) is a reconstruction algorithm recently explored in the field of ultrasound computed tomography (USCT), for high resolution 3-dimensional imaging of the breast. Ultrasound tomography-based imaging, devoid of radiation, can be a safe tool for breast cancer screening and diagnostics. FWI usually inverts for single parameter, typically speed of sound. However, quantitative imaging of other acoustic parameters such as density and attenuation, also can be performed. Such multi-parameter inversions can be especially useful in differentiating various breast tissues, especially to detect any malignancy, leading to more confidence in diagnostics. Nevertheless, the need for extensive computational resources and difficulty in overcoming crosstalk, i.e. separating influence of multiple parameters on the result, decreases its practical applicability.

As a method to improve the single parameter inversion, and to obtain quantitative images of the other acoustic parameters, we propose to make use of linear empirical relationship between speed of sound and density in the inversion process. The linear empirical relationship is used to create intermediate density maps based on the estimated speed of sound map at each iteration and is fed back to inversion process as heterogeneous density map providing prior density information. This heterogeneous density map replaces the constant density value typically employed in the inversion process.

In addition, we estimate the uncertainty associated with these inversions, using an uncertainty quantification (UQ) method based on stochastic variational inference, which was previously proposed for quantifying the confidence of the speed of sound estimate from FWI.

This work uses in-silico and in-vitro phantom datasets to assess the performance of the improved inversion with density feedback and the uncertainty quantification. In addition, the resolution of the 2D-imaging method for given probe centre frequency is quantified using an in-silico resolution phantom with breast tissue acoustic properties.

Authors: HARINDRANATH, Aparna (Imperial College London); Dr BATES, Oscar (Imperial College London); Dr CALDERON AGUDO, Oscar (Imperial College London); GUASCH, Lluis

Presenters: HARINDRANATH, Aparna (Imperial College London); GUASCH, Lluis

Session Classification: Reconstruction Methods & Modeling

Track Classification: oral presentations