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Computed Ultrasound Tomography in Echo Mode – current status

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Computed Ultrasound Tomography in Echo Mode (CUTE) maps the tissue's speed-of-sound (SoS) using conventional handheld limited-aperture echo ultrasound (US) probes. The technique consists of a sequence of steps that can be performed in real time: beamforming of US images under varying transmit- and receive steering angles, detection of echo shift between different angle combinations, SoS inversion from the echo shift data. Recently we have adapted CUTE to also image the US attenuation coefficient.

After a recap of the basic principles and the recent clinical results, this talk will focus on discussing critical aspects of CUTE: (i) the role of regularization for quantitative imaging. Despite the ill-posedness of the SoS inversion, quantitative imaging is in principle feasible subject to an appropriate prior. (ii) the challenge of imaging real tissue. Wave aberrations at short scale heterogeneities of SoS degrade the echo shift data, leading to artifacts and –more importantly– reduced quantitative accuracy. (iii) artificial neural network based SoS inversion. This may be a clever alternative to a full-wave inversion to account for aberration effects, however, care needs to be taken to appropriately design the training data.

Authors: JAEGER, Michael (Institute of Applied Physics, University of Bern); KORTA MARTIARTU, Naiara (Institute of Applied Physics, University of Bern); SALEMI YOLGUNLU, Parisa (Institute of Applied Physics, University of Bern); JULES, Bloom (Institute of Applied Physics, University of Bern)

Presenter: JAEGER, Michael (Institute of Applied Physics, University of Bern)

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