Robust recovery strategies for the acoustic inverse scattering problem in anisotropic systems

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Abstract

Application Area: Cardiovascular, Cancer Modality: PAT, US, MR

1 Clinical Background

The problem of inverse scattering appears in multiple ways in medical imaging. Photoacustic Imaging (PAT), ultrasound, and elastography all are all based on the scattering of acoustic waves in biological tissue. We want to backtrack the scattering patterns to the underlying tissue properties. This tissue is generally anisotropic and can include brain folds, blood vessels or lactiferous ducts. To increase the robustness to nois our reconstruction algorithms include regularization teqniques fit to this anisotropic geometry (e.g. shearlets).

2 Aims and Methods

At the moment we are focusing on modeling the 1-dim Helmholtz equation and inverting it for inhomogenous media using the stacked wave inversion. This means we are exciting waves with different frequencies and thus overdetermine the linear system for the stiffness of the tissue. Regularization is done with wavelets. Questions that arise here are sensibility to noise, frequency, distance of the frequencies and strength of the regularization. Once we move to 2-dim waves we will try regularization based on shearlets. After that we want to apply the methods to the real world data of MRE brain scans. It is not yet clear whether we want to go for high resolution or diagnostically useful stiffness values.