Nonlinear Waveform Inversion for Quantitative Ultrasound

Software & Algorithms

MedTech & Digital Health

A Nonlinear Waveform Inversion (NWI) algorithm enhances ultrasound imaging by using Recurrent Neural Networks (RNNs) to reconstruct material properties from acquired signals. Unlike traditional methods, it captures nonlinear acoustic behavior, improving resolution, contrast, and anatomical interpretation for greater diagnostic precision.
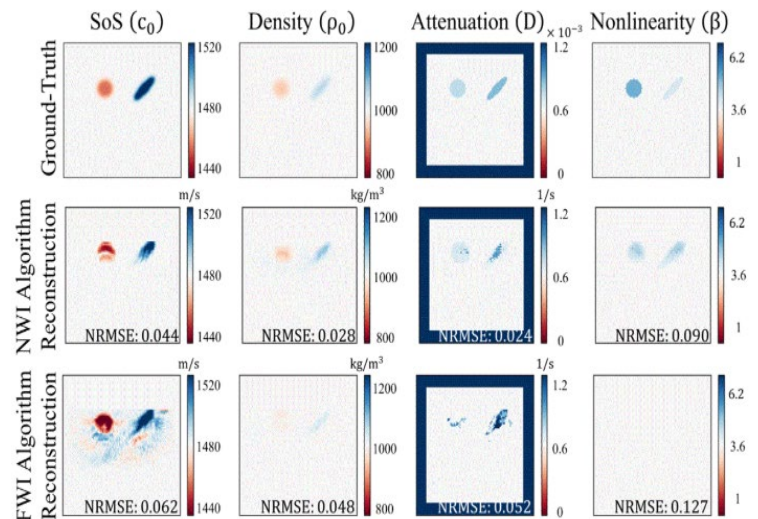
Reconstruction of simulated medium properties (headers), using the NWI algorithm compared to the FWI. The left and right objects are fat and liver, respectively.

APPLICATIONS

- Discerning between benign and malignant breast tumors
- Identifying muscle loss and fatty muscular degeneration
- Differentiating healthy and diseased tissues (e.g., in livers affected by NAFLD)
- Quantifying fat levels in the liver (critical for monitoring NAFLD and NASH)

DEVELOPMENT STAGE

Algorithm development and validation completed, with superior performance demonstrated versus standard methods. Clinical translation currently in progress.

DIFFERENTIATION

Increases diagnostic reliability

Non-invasive and non-ionizing

Reduced processing time and costs

Easily integrated into existing medical ultrasound equipment

Adaptable to other imaging techniques (photoacoustic, seismology)