A method for reducing speckle and improving resolution in ultrasound imaging

Value Proposition

For many years, ultrasound imaging has been an important and popular medical imaging method. The speckle texture in ultrasound images limits the detectability of low contrast targets. With size on the order of the system resolution, the speckle artifact is often a barrier to clinical diagnosis. A large number of beamforming and post-processing schemes are used in commercial ultrasound scanners to improve image resolution and target speckle texture. However, conventional beamforming methods typically have limited signal-to-noise ratio at depth and a narrow depth of field around the fixed transmit focus.

Technology

Inventors at Duke have reported a method for reducing speckle and improving resolution in ultrasound imaging. This invention is intended to be incorporated into existing technology to improve the detectability with ultrasound diagnostics. Specifically, this is an improved method for synthetic aperture beamforming that decomposes a set of focused transmit beams into their constituent components – diverging waves from individual array elements. The recovery of data from this set enables synthetic transmit focusing at all points in the field of view without beam shape or focal depth artifacts. The method is compatible with many existing technologies for image improvement including pulse sequencing, receive beamforming and image post-processing. The technique is well-suited for parallel processing architectures and beamforming software, which are increasingly common. This invention has been tested experimentally taking *in vivo* images of human liver using existing commercial systems and has

shown significantly improved transmit depth of field and signal-to-noise ratio.

Other Applications

In addition to speckle reduction, this technology could more generally be used for post-processing on the recovered aperture domain signals. This could include applications such as adaptive weightings and aberration correction.

Advantages

- Allows for ultrasound resolution improvement and speckle reduction without reducing acquisition rate, limiting active aperture extent or performing costly post-processing
- 18% signal-to-noise ratio improvement in detectability of the low contrast target compared to speckle background
- Compatible with existing scanner architectures
- Has been tested experimentally using a commercial ultrasonic scanner
- Works flexibly with varying transmit focusing schemes
- Unlike many aperture coding schemes, it is also compatible with harmonic signals, which are clinically important for reducing clutter in images

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Publication(s)

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External Link(s)

• From the lab of Prof. Gregg Trahey