Robust microbubble tracking for super resolution imaging in ultrasound

Currently ultrasound resolution is limited by diffraction to approximately half the wavelength of the sound wave employed. In recent years, super resolution imaging techniques have overcome the diffraction limit through the localization and tracking of a sparse set of microbubbles through the vasculature. However, this has only been performed on fixated tissue, limiting its clinical application. This paper proposes a technique for making super resolution images on non-fixated tissue by first compensating for tissue movement and then tracking the individual microbubbles. The experiment is performed on the kidney of an anesthetized Sprague-Dawley rat by infusing SonoVue at 0.1× original concentration. The algorithm demonstrated in vivo that the motion compensation was capable of removing the movement caused by the mechanical ventilator. The results show that microbubbles were localized with a higher precision, reducing the standard deviation of the super localizations from 22μm to 8 μm. The paper proves that the restriction of completely fixated tissue can be eliminated, when making super resolution imaging with microbubbles.