3D Printed Calibration Micro-phantoms for Validation of Super-Resolution Ultrasound Imaging - DTU Orbit (23/10/2019)

3D Printed Calibration Micro-phantoms for Validation of Super-Resolution Ultrasound Imaging

This study evaluates the use of 3D printed phantoms for super-resolution ultrasound imaging (SRI) algorithm calibration. Stereolithography is used for printing calibration phantoms containing eight randomly placed scatterers of nominal size 205 µm × 205 µm × 200 µm. The purpose is to provide a stable reference for validating new ultrasonic imaging techniques such as SRI. SRI algorithm calibration is demonstrated by imaging a phantom using a λ/2 pitch 3 MHz 62×62 row-column addressed (RCA) ultrasound probe. As the imaging wavelength is larger than the dimensions of the scatterers, they will appear as single point spread functions in the generated volumes. The scatterers are placed with a minimum separation of 3 mm to avoid overlap of the point spread functions of the scatterers. 640 volumes containing the phantom features are generated, with an intervolume uniaxial movement of 12.5 µm, emulating a flow velocity of 2 mm/s at a volume frequency of 160 Hz. A superresolution pipeline is applied to the obtained volumes to localise the positions of the scatterers and track them across the 640 volumes. The standard deviation of the variation in the scatterer positions along each track is used as an estimate of the precision of the super-resolution algorithm, and was found to be between the two limiting estimates of (x, y, z) = (17.7, 27.6, 9.5) µm and (x, y, z) = (17.3, 19.3, 8.7) µm. In conclusion, this study demonstrates the use of 3D printed phantoms for determining the precision of super-resolution algorithms.

General information
Publication status: Accepted/In press
Organisations: Department of Health Technology, Biomedical Engineering, Center for Fast Ultrasound Imaging, Mem\ns Applied Sensors Group, Polymer Cell, Immunobiology and Biomimetics, BK Medical ApS
Contributors: Ommen, M. L., Schou, M., Beers, C., Jensen, J. A., Larsen, N. B., Thomsen, E. V.
Number of pages: 4
Publication date: 2019

Host publication information
Title of host publication: Proceedings of the IEEE International Ultrasonic Symposium 2019
Publisher: IEEE
Electronic versions:
fulltext
Source: PublicationPreSubmission
Source ID: 195364810
Research output: Chapter in Book/Report/Conference proceeding – Article in proceedings – Annual report year: 2019
Research: peer-review