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A combined platform for b-mode and real-time optoacoustic imaging based on raw data acquisition

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Optoacoustic imaging is a new promising medical imaging modality combining the benefits of optical and acoustical methods. Optoacoustics allow to make the high intrinsic optical contrast in biological tissue accessible to acoustical detection. In addition, the possibility of using nanoscaled contrast agents makes of optoacoustics an ideal candidate for molecular imaging. While optoacoustics are an emerging imaging modality with poor clinical experience, ultrasound is widely used for diagnosis. Accordingly, optoacoustic images are much harder to interpret than b-mode images. For this reason, we developed a hardware platform which allows combined b-mode and optoacoustic imaging using a 2-in-1 transducer with arrays of different frequency for the two modalities. The system supports simultaneous data acquisition of 128 channels with a sample rate of 80 MSamples allowing the usage of transducers with frequencies up to 20 MHz. The unprocessed data is transferred to a PC where the images are reconstructed with algorithms adapted to both modalities. A software for hardware control, data processing and visualization in real-time was developed. B-mode and optoacoustic images of tissue phantoms were generated and different types of nanoparticles were used as optoacoustic contrast agent. Further, first in-vivo measurements underlying the high potentials of the combined system were obtained.