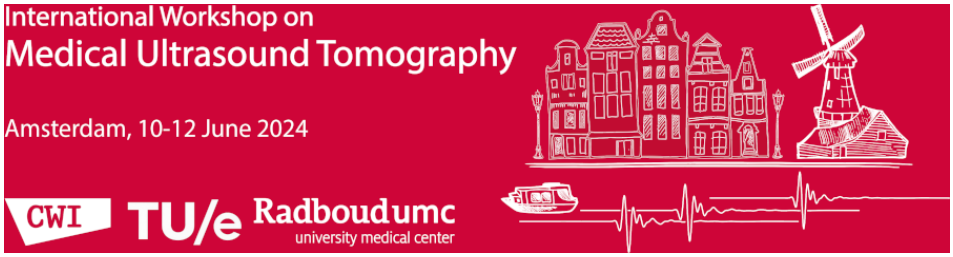

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Preliminary research on in vivo brain imaging using ultrasound computed tomography

Monday, June 10, 2024 3:20 PM (20 minutes)

Background:
Intracranial soft tissue imaging using traditional ultrasound is a difficult task due to the presence of the skull, which strongly reflects and attenuates the ultrasound signal. To address this problem, we have conducted preliminary research on full waveform inversion (FWI)-based ultrasound computed tomography (USCT) for in vivo human brain imaging.

Material and Method:
We have developed a prototype system for transmitting and receiving signals in single-channel transcranial ultrasound tomography. The prototype system consists of a pair of piston probes, an electric rotary stage, an optical tracking positioner, and a transmitting and receiving system. The probes operate at a center frequency of 500kHz. The rotary stage is used to rotate the transmitting and receiving probes. The optical tracking positioner records the position of the transducer relative to the human head, which is located in the center of the rotary stage. The transmitting and receiving system transmits and captures the signals through the brain. Using the received signal, a sound-speed image of the brain is reconstructed using FWI.

Results:
We conducted experiments on the head of one healthy volunteer. The transmitting and receiving probes were positioned along the radial direction. A total of 64 transmit events were configured, with each event consisting of 128 received traces. Although the preliminary result still has poor image quality, it shows the potential of in vivo brain imaging using ultrasound computed tomography.

Conclusion:
Traditional ultrasound has limitations in visualizing intracranial soft tissue. Full waveform inversion-based ultrasound computed tomography has the potential to enable in vivo imaging of the human brain, making it a promising non-invasive modality for clinical applications in brain diseases.

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