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**UNIVERSITÄT
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Seminar über Biomedizinische Photonik

Referent/in: Dr. Naiara Korta Martiartu, Signal Processing Laboratory 5, EPFL

Titel: An Adjoint Matrix-Imaging Framework for Speed-of-Sound Tomography in Pulse-Echo Ultrasound

Ultrasound imaging is fundamentally limited by the assumption that pressure waves propagate through tissue at a constant speed. In reality, spatial variations in the speed of sound induce wavefront distortions (aberrations) that degrade image quality. Mapping this tissue property is therefore key to improving wave propagation modeling and thereby the resolution and contrast of ultrasound images. Beyond this role, the speed of sound is itself a promising biomarker for diagnosing diseases such as breast cancer. In this talk, I present a tomography technique for estimating the speed-of-sound distribution without relying on ray-based simplifications commonly used in the literature. The method combines a matrix imaging framework, used to isolate phase aberrations across the entire field of view, with a paraxial approximation of the Helmholtz equation to model wave propagation in heterogeneous tissue. We then apply adjoint-state techniques to compute the exact sensitivities of these aberrations and infer the underlying speed-of-sound distribution from them. The inversion thus naturally accounts for wave phenomena such as diffraction and refraction, while simultaneously yielding aberration-corrected ultrasound images. The performance of our tomography technique is demonstrated in experimental tissue-mimicking phantoms and in vivo breast imaging data. More broadly, this approach is applicable to other wave-based imaging modalities using multi-element arrays.

Zeit: Wednesday 22.4.2026, 10:15 Uhr

Ort: Room A97, ExWi, Sidlerstrasse 5, 3012 Bern