Advanced image reconstruction for MR elastography of the liver

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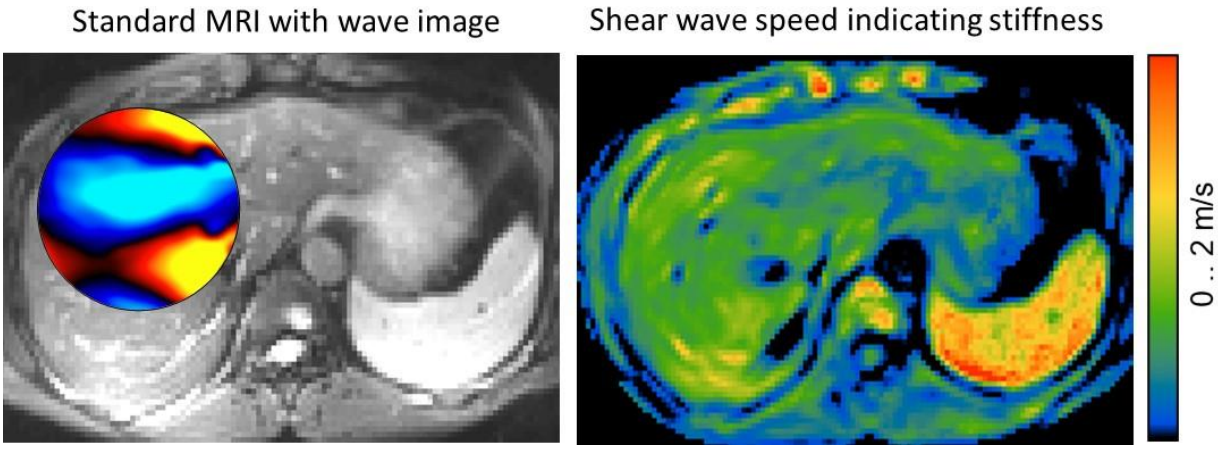
Theme: Mechanics/tissue structure

Background: MR Elastography (MRE) provides information about the stiffness of different tissue types noninvasively. Especially for applications in the liver the stiffness is an important biomarker for a range of different diseases, such as nonalcoholic fatty liver disease or liver lesions. The main challenge for MRE in the liver is movement due to breathing. This restricts the achievable image resolution, volumetric coverage, accuracy and reproducibility.



Hypothesis: Advanced image reconstruction can be used to enable MRE of the liver with increased resolution, improved volumetric coverage and higher accuracy and reproducibility compared to the current state-of-the-art.

Methods: In this project, we want to build on previous work on MRE of the liver carried out within BIOQIC and incorporate motion-correction and advanced regularisation approaches into MRE reconstruction. We will combine a UWB-system with an MRE sequence using an open-source vendor-independent sequence programming environment. In a next step, a motion model will be created to obtain a quantitative motion surrogate which can be used for slice tracking. This will then allow for prospective motion-corrected free-breathing MRE of the liver. As a final step advanced image reconstruction approaches (e.g. utilising unrolled neural-network based iterative reconstruction schemes) will be utilised to further improve the quality of MRE and reduce the scan time.

Collaboration: The PhD students will work closely with Prof. Sack's group on the MRE implementation of the liver. Furthermore, BIOQIC projects concerned with other imaging approaches of the liver (e.g. CEST or PET-MR) will benefit from the methods developed here.

Impact: The outcome of this project will make MRE of the liver more robust, more accurate and easier to apply in clinical practice which will enable widespread use of this powerful medical imaging approach.

Please contact Christoph Kolbitsch (christoph.kolbitsch@ptb.de) for any further questions on this project.