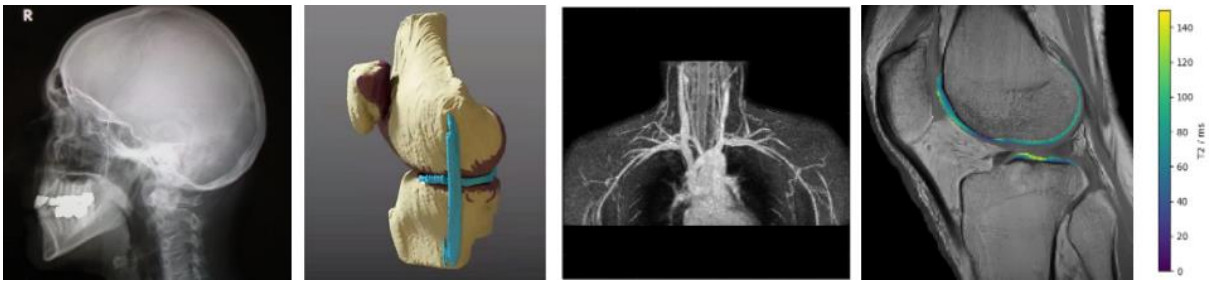
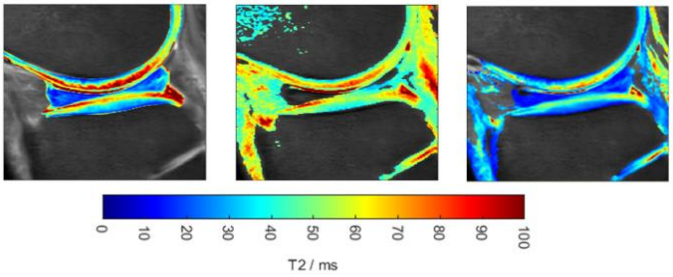


Master's Thesis

Advancing the understanding of the physics behind quantitative knee MRI

Description

Quantitative MRI (qMRI) promises to detect early signs of osteoarthritis in knee cartilage, but their long scan times prevent their clinical application so far. Hence, fast sequences were proposed that can simultaneously acquire morphologic and quantitative information (i.e., on the tissue relaxation times T_2 or $T_{1\rho}$). However, these methods lack accuracy with respect to more established reference methods (see example image). Within the framework of the proposed project, your task is the to "dig into" the physics behind the measurements and to primarily address aspects of image acquisition. For that purpose, you will make use of experiments in a dedicated qMRI phantom and systematically vary the MRI sequence parameters. If interested, you can also undertake the clinical translation of your findings by performing measurements in human cadaveric samples and specimens. You will evaluate your quantitative imaging data by programming your own tools, preferentially in Python, and acquire knowledge on MRI physics to explain your observations. Depending on your interests, you will apply MRI signal simulations to complement your experiments or dive into machine learning methods to improve the accuracy of the measurements.



Example T2 maps acquired in knee cartilage. From left to right: reference T2 map, "MIXTURE" T2 map, "QDESS" T2 map.

Your Profile

- Physics or engineering student with good grades
- Familiarity with programming in Python or MATLAB (optionally also PyTorch)
- A strong interest in Magnetic Resonance Imaging and the interface of physics and medicine

What we Offer

The Department for Diagnostic and Interventional Radiology offers an interdisciplinary environment with medical doctors, clinician scientists, post-docs in physics, and PhD candidates in engineering and physics and the possibility to scan on state-of-the-art clinical MRI scanners. Research on MRI physics is performed in close collaboration with the 'Musculoskeletal and Machine Learning' work group, which is characterized by mutual support, close supervision, and regular scientific meetings.

Whom to Contact

Interested? Then send an email to tnolte@ukaachen.de or dtruhn@ukaachen.de. We are looking forward to hearing from you.

UNIKLINIK RWTH AACHEN