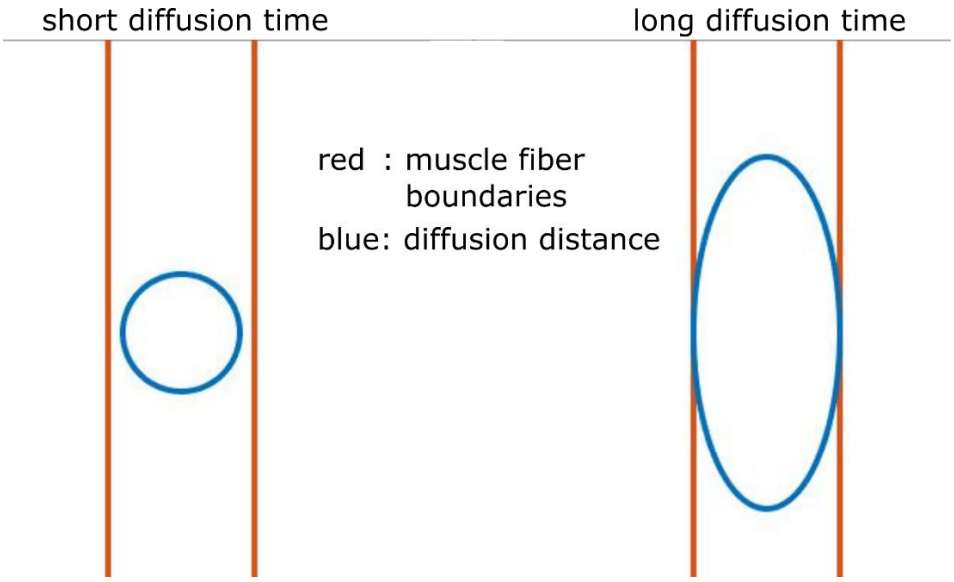
Investigating the dependency of DTI and IVIM parameters on the diffusion time in skeletal muscle

Diffusion tensor imaging (DTI) and intravoxel incoherent motion imaging (IVIM) are two Magnetic Resonance Imaging (MRI) methods used to investigate the tissue microstructure by measuring the diffusion processes in tissue. By measuring diffusion in many directions a so-called diffusion tensor can be derived (DTI). In the IVIM model, not only the diffusion process is modelled, but also a perfusion compartment is taken into account. There are two important aspects influencing these diffusion measurements: the strength of the diffusion weighting and the diffusion time. The strength of the diffusion weighting, given in the so-called b-value, determines the sensitivity of the measurement to the diffusion process. The effect of varying the strength in relation to DTI and IVIM parameters is well understood. However, little is known about the effect of diffusion time on DTI and IVIM parameters in skeletal muscle.

Diffusion in skeletal muscle is hampered, e.g. by cell membranes, vessel walls and intracellular structures such as the sarcoplasmic reticulum and mitochondria. For short diffusion times, the diffusion process might still appear as free, unrestricted diffusion while for longer diffusion times the particles have reached the fiber boundaries and the diffusion becomes restricted. Thus, taking the diffusion time into account in MRI diffusion measurements might allow for deeper understanding of the underlying tissue microstructure.



In this project, the candidate will investigate the influence of the diffusion time on DTI and IVIM parameters using MRI measurements and simulations.

Requirements

We are looking for Bachelor and Master students with a technical background (e.g. Physics, Medical sciences, Technical Medicine, Computational Sciences, Mathematics) with an interest in medical imaging. Experience with programming (preferably in Matlab) is strongly desired.

Learning goals

Next to general programming and research skills, the student will gain a in depth understanding of MRI physics and data processing. **Depending on the length of the project and the results, we will aim at getting the work published by the end of the project, particular for 1-year projects.**

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