LMU KLINIKUM
Klinik und Poliklinik für Radiologie

MSc Thesis in MRI Physics:

Analysis of microstructures using diffusion-weighted MRI of inert fluorinated gases

Background:

Magnetic resonance imaging (MRI) of the lungs using inert fluorinated (19F) gases is a noninvasive imaging technique that can provide valuable diagnostic information on the pulmonary function [1,2]. In particular, diffusion-weighted (DW) MRI of 19F gases enables the assessment of parenchymal integrity by quantifying the diffusion coefficient of the gas molecules [3]. The gas molecules are hindered in their diffusive motion by the intricate structure of the lung, leading to a reduced measured diffusion coefficient. Conversely, a loss of tissue integrity leads to an increase in the measured diffusion coefficient, thus potentially enabling the identification lung disease at an early stage. However, the accuracy of this technique remains to be evaluated.

Tasks & Goals:

This thesis aims to investigate 19F diffusion-weighted MRI using phantom measurements. An initial step is going to be the construction of a suitable imaging phantom, which mimics certain properties of the structure of lung parenchyma. Afterwards, 19F diffusion-weighted MRI will be performed on a pre-clinical MRI scanner. Finally, the experimental findings will be compared to analytical results and numerical simulations.

Requirements:

- Highly motivated candidate with a strong interest in medical imaging
- Experience in programming with either Python or MATLAB
- Ideally, knowledge of magnetic resonance imaging and preferably diffusion-weighted MRI
- Scientific curiosity and creativity

The imaging experiments will be performed at the Helmholtz Zentrum München and the MSc student will be provided a workplace at the Department of Radiology of the LMU in Großhadern.

Contact:

If you are interested, please contact (including a short CV, BSc certificate, and motivational letter) Prof. Dr. Olaf Dietrich (olaf.dietrich@med.uni-muenchen.de) and Dr. Moritz Schneider (moritz.schneider@med.uni-muenchen.de) with cc to Dr. Markus Kraiger (markus.kraiger@helmholtz-muenchen.de).

1. Couch MJ et al., Inert fluorinated gas MRI: a new pulmonary imaging modality. NMR Biomed. 2014;27(12):1525-34.
2. Kaireit TF et al. Comparison of quantitative regional ventilation-weighted fourier decomposition MRI with dynamic fluorinated gas washout MRI and lung function testing in COPD patients. J Magn Reson Imaging. 2018;47(6):1534-1541.
3. Carrero-González L et al. In vivo diffusion-weighted MRI using perfluorinated gases: ADC comparison between healthy and elastase-treated rat lungs. Magn Reson Med. 2013;70(6):1761-4.

Direktor
Prof. Dr. med. Jens Ricke

Ansprechpartner
Dr. rer. nat. Morit Schneider
Prof. Dr. rer. nat. Olaf Dietrich
MR Physics and Quantitative Imaging
Josef Lissner Laboratory for Biomedical Imaging
Tel. +49 89 4400-74622
Fax +49 89 4400-74627
olaf.dietrich@
med.uni-muenchen.de
www.lmu-klinikum.de
www.radiologie-lmu.de