

PhD Student Sofie Rahbek

**Project title:** Development of Quantitative Magnetic Resonance Imaging (qMRI) Methods for Radiotherapy Response Studies.

### **Project overview**

In my work with diffusion-weighted (DW-) MRI data I have tried to develop a data-driven analysis strategy to extract signal information related to the underlying tissue structure without implying specific models. I have worked on a novel extension of the non-negative matrix factorization (NMF). Applications go beyond DW-MRI data, and the decomposition method can be useful for analysis within several areas of MRI. In an upcoming paper, recently submitted to Magnetic Resonance in Medicine, a thorough demonstration of the method is presented showing results of decomposing both DW- and relaxometry data.

Another part of my project concerns prediction of response during radiotherapy from repeated DW-MRI data, i.e. a classification of tumors into “responders” and “non-responders”. A full analysis framework, going from raw data to prediction values, has been developed. It is based on the above-mentioned decomposition analysis, but also includes several steps for feature extraction, normalization and selection before the final classification model. A paper is being prepared about the framework and utility of the decomposition method for analysis of tumor tissue.

A third part of my project concerns optimization of DW-MRI scans for use in radiotherapy. A high geometric accuracy together with a high resolution and SNR are desired for the scans. Currently I try to optimize the point-spread-function of a relatively new DW-MRI sequence called SPLICE. The method has high geometric accuracy and thus has the potential of becoming the new standard DW-MRI scan within the area of treatment planning. Simulations are used to suggest optimized sequences, and scans of phantoms to test the new settings have just started. Hopefully, there will soon be material for a paper on this.

### **Publications**

Submitted to Magnetic Resonance in Medicine (MRM):

*“Data-driven separation of MRI signal components for tissue characterization”*

Sofie Rahbek, Kristoffer H. Madsen, Henrik Lundell, Faisal Mahmood, Lars G. Hanson.

### **Poster presentations**

- Poster at ISMRM NORDIC 2019

### **Talks**

- Power pitch at ISMRM NORDIC 2019

- Flash talk at DCCC annual meeting 2019.
- Small presentation at ESTRO Physics workshop 2018.

### **Planned activities in 2021**

- Participation in the ISMRM 2021 conference.
- Participation in the MR in RT Symposium 2021
- Submit two papers
- Hand-in thesis