Two PhD positions in quantitative MRI

Next-generation biomarker mapping

The team of Prof. Jessica Bastiaansen is looking for a talented PhD students to develop novel quantitative imaging technology for clinical MRI systems. The candidate will join an interdisciplinary research initiative in active collaboration with Siemens Healthineers (on-site scientists), clinicians from the Department of Interventional and Pediatric Radiology (DIPR), and physicists and engineers from the Translational Imaging Center (TIC) at the SITEM-INSEL. The prospective students will enroll in the Graduate School of Biomedical Engineering at the University of Bern.

PROJECT DESCRIPTION • Different tissue components have unique MRI signal signatures that determine the contrast in MRI data, and enable the measurement of anatomy and function in living tissues. Nevertheless, the quantification of tissue properties with MRI is inherently complex, and the experiments required to untangle the individual signal contributions often cannot be performed within acceptable measurement times in large tissue volumes. The presence of magnetic field inhomogeneities may further lead to image artifacts, and may confound the quantification of disease biomarkers. Despite ongoing advances in medical imaging technology, invasive biopsies remain the standard of care for a variety of diseases. These aforementioned limitations inspire a noninvasive imaging strategy that encodes simultaneously for field inhomogeneities (local signal frequencies) as well as tissue properties (relaxation times, tissue structure).

The goal of the project is to develop an MRI method that exploits magnetic resonance signal asymmetries of a bSSFP sequence for frequency-resolved tissue property quantification at 3T and 7T. This will allow the removal of image artifacts and the extraction of tissue specific MR parameters such as T1, T2, and T2*. The SNSF funded project will bring a new perspective on quantitative MRI. This will help to maximize the amount of information derived from MRI exams to address unmet needs in healthcare, especially for the staging of liver disease and heart failure prognosis. The challenge of the project lies in the multi-dimensional nature of the data acquisition and in the robust identification of MR property clusters as potential biomarkers.

The two prospective PhD candidates will work under the supervision of Dr. Jessica Bastiaansen and will be involved in all specifics of the project. After familiarizing themselves with both the technical and practical aspects of MRI research, they are both expected to participate in MRI sequence programming efforts, perform independent MRI acquisitions (phantoms, volunteers), participate in clinical studies, develop image reconstruction and analysis algorithms, and present their work at international conferences and publications. Within this collaborative project, each candidate will have a different focus:

Focus of PhD position 1: The candidate will work on the development and translation of the imaging framework to high magnetic field (3T to 7T), the implementation of multi-dimensional signal encoding strategies to maximize the extraction of tissue properties and quantitative biomarker maps, the robustness of the technique to quantify disease biomarkers, and target liver applications.

Focus of PhD position 2: The candidate will work on the optimization of MR signal asymmetry detection, the development of algorithms and an image reconstruction pipeline for biomarker mapping, the identification of MR property clusters as biomarkers of disease, the acceleration of the imaging technique by minimizing signal sampling, and target cardiac applications.
QUALIFICATIONS • We are an enthusiastic and young research team that looks for creative and proactive team members. We value curiosity and critical thinking.
Further requirements:
  ▪ MSc degree in Biomedical/Electrical Engineering, Computer Science, Life Science, Physics, Applied Mathematics or equivalent. Being at ease with MRI physics is desirable.
  ▪ Programming skills (Matlab and/or Python, C++ desirable).
  ▪ At ease with optimization mathematics, signal processing, image reconstruction.
  ▪ Prior experience with MRI and image processing are an advantage
  ▪ Excellent written and oral communication skills in English (written and oral)
  ▪ Strong team spirit and ability to work autonomously

RESEARCH ENVIRONMENT • The TIC at the SITEM-INSEL is an interdisciplinary research environment with state-of-the-art 3T and 7T systems dedicated to research. Clinical translation is furthermore supported by MRI scanner access and established collaborations within the DIPR at the INSEL, one of five Swiss university hospitals. The SITEM-INSEL hosts various research groups, a variety of start-ups, and fosters entrepreneurship. Through collaborations with the AI center (CAIM) and the ARTORG institute, the environment contributes to thriving (bio)medical research activities in the capital of Switzerland.

OFFER • Some of the perks of this PhD position include:
  ▪ Access to state-of-the-art research environment
  ▪ Opportunities to help in the supervision of MSc students
  ▪ Attractive work conditions (salary, vacation days, benefits)

HOW TO APPLY • For information about this PhD position or to send your application (please include a CV, a motivation letter stating the PhD position you are interested in, and two references), please contact Dr. Jessica Bastiaansen (jbastianen.mri@gmail.com)