Intern Position

BPALP - Brain PALPation by using MR passive elastography

BIOMAPS – Université Paris-Saclay, CNRS, INSERM, CEA

Locations: CEA Neurospin, Saint Aubin
CEA SHFJ 4 Place du Gal Leclerc 91401 Orsay

Opening: Now for 4 to 6 months, Deadline June 1st, 2022.

Partners of the project: Dre. Angéline Nemeth (angeline.nemeth@universite-paris-saclay.fr, BIOMAPS), Dr. Jean-Luc Gennisson (jean-luc.gennisson@universite-paris-saclay.fr, BIOMAPS), Dr. Benoit Larrat (benoit.larrat@cea.fr, Neurospin).

Summary of the project:

Elastography is an imaging technique (with MRI or ultrasound (US)) that allows recovering biomechanical properties (BMP) of soft tissues. Brain elastography has been studied extensively recently and has allowed, mainly *ex vivo*, to better understand tumor or degenerative diseases. But this technique suffers from drawbacks for daily clinical practice. In US, due to skull bone it is not possible to non-invasively investigate brain BMP without neurosurgery. In MRI, it is necessary to vibrate the head from an external actuator which makes difficult daily clinical diagnosis. Thus, BMP of brain are unwell known *in vivo* and are poorly used as a biomarker for cancer diagnosis or treatment monitoring compared to other organs.

We have developed an original MRI method without external vibrator for the diagnosis of brain tumors with an innovative technique coming from US imaging called passive elastography. MR sequences were developed on clinical magnets 3T (Siemens) for BMP understanding and daily clinical practice. A clinical protocol to acquire 50 patients in ongoing. On 7T preclinical magnet (Bruker), others sequences have been developed for a more fundamental understanding of BMP. These two parallel developments are currently validated with "gold standard" US elastography in humans during neurosurgery and in small animals respectively.

For the internship two goals will be considered:

- the intern will help for the development of a 3D reconstruction tool to get BMP in brains. A specific algorithm based on passive elastography approach, which briefly consists in the time cross-correlation of raw data in each spatial point of the brain, will have to be optimized and accelerated. To do that preclinical data and clinical data would be utilized.
- the intern will participate to the programming of specific passive elastography sequence on a TEP/MR device (GE). Experiment will be performed to calibrate the sequence with phantoms and dedicated vibrator to generate artificial vibration in phantoms.

At last, this project requires a good knowledge of programming (Matlab, C++). Theoretical skills in physics of MRI, acoustics or in biomechanics are also welcome, especially in elastography methods. Comparison will be done with ultrasound elastography, so an experience in ultrasound could be interesting.

Contacts:

Applicants interested in this project can send a CV with references, motivation letter to Dr. Jean-Luc Gennisson (jean-luc.gennisson@universite-paris-saclay.fr)