PhD student position

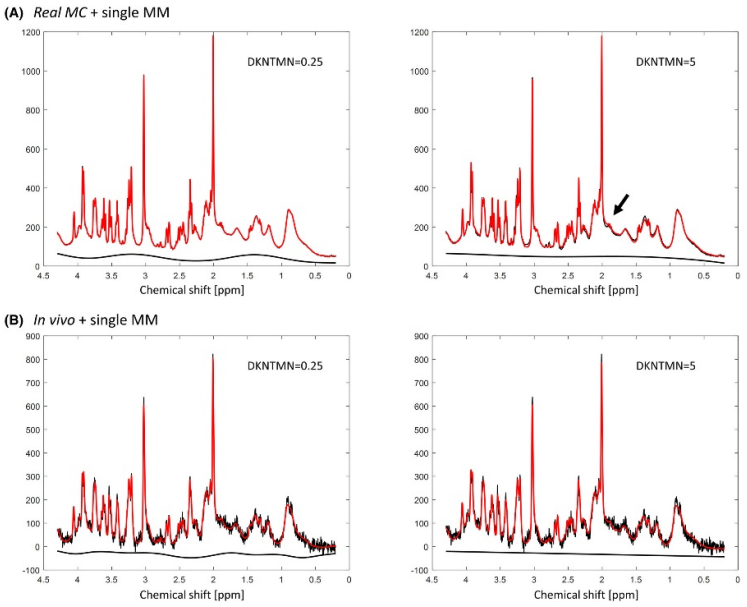
Location : EPFL AVP-CP CIBM-AIT, Bâtiment CH F.
Dates: Spring/Autumn semester 2022, Spring/Autumn semester 2023

Baseline estimation in short echo time brain spectra at ultra-high magnetic field

Project description

A relatively unconstrained spline baseline is often used during the fitting process to address unpredicted spectroscopic components (smoothly varying components and spurious signals arising through imperfections during data acquisition). Finding the optimal degree of baseline flexibility is mandatory for reliable metabolite concentration estimates, yet few studies have investigated this topic in detail. In LCModel, the stiffness of the spline baseline is controlled by the parameter DKNTMN (minimum allowed spacing between spline knots)..The default value is set to 0.15 ppm (low stiffness), and all values equal to or higher than 1 ppm result in a high baseline stiffness. A study performed at 9.4T in humans has reported several changes in metabolite concentrations when quantifying with different DKNTMN values, but no conclusion on the best value was drawn due to lack of ground truth. To draw such a conclusion, an extensive Monte Carlo (MC) simulation study is necessary.

In this study, we aimed to assess the impact of the LCModel baseline stiffness on metabolite and MM quantification using in vivo and MC simulated spectra at 9.4T and 14.1T.



Spectra obtained with MC simulation of real experimental conditions (with baseline) showing a mismatch between the raw data and the LCModel fit (arrow) when quantifying with *DKNTMN* = 5 ppm. B, In vivo acquired spectra from the same rat using DKNTMN = 0.25 ppm (left) and DKNTMN = 5 ppm (right). From Ref 1.

References:

[1] D. Simicic, V. Rackayova, L Xin, I Tkac, T Borbath, Z Starcuk, J Starcukova, B Lanz, C. Cudalbu*. “In-vivo macromolecules in Rat Brain 1H MR Spectra at 9.4T: parametrization, spline baseline estimation and T2 relaxation times” Magn Reson Med. 2021 Jul 15. doi: 10.1002/mrm.28910.

[2] C Cudalbu*, KL Behar, PK Bhattacharyya, W Bogner, T Borbath, RA de Graaf, R Gruetter, A Henning, C Juchem, R Kreis, et al, “Contribution of macromolecules to brain 1H MR spectra: Experts' consensus recommendations” NMR Biomed. 2020 Nov 25:e4393. doi: 10.1002/nbm.4393

Supervisors:

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Skills:

- **Qualifications, previous experience and background:** This project is suitable for students with a background in physics or biomedical physics or biology/biochemistry who are interested in biomedical applications of proton magnetic resonance spectroscopy (^{1}H-MRS) and imaging (MRI).
- **Desirable:** Course PHYS-438 (Fundamentals of biomedical imaging), Programming experience (Matlab,..)

How to apply:

Applications will be considered until the position is filled, so interested candidates are encouraged to apply early. Please send your CV and motivation letter to cristina.cudalbu@epfl.ch

About CIBM

The CIBM Center for Biomedical Imaging was founded in 2004 and is the result of a major research and teaching initiative of the partners in the Science-Vie-Société (SVS) project between the Ecole Polytechnique Fédérale de Lausanne (EPFL), the Université de Lausanne (UNIL), Université de Genève (UNIGE), the Hôpitaux Universitaires de Genève (HUG) and the Centre Hospitalier Universitaire Vaudois (CHUV), with the generous support from the Fondation Leenaards and Fondation Louis-Jeantet.
CIBM brings together highly qualified, diverse, complementary and multidisciplinary groups of people with common interest in biomedical imaging.
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