



INTERNSHIP PROGRAM FOR INTERNATIONAL STUDENTS

INTERNSHIP SUBJECT FORM

Name of the Host Laboratory	CMAP
Website of the Host Laboratory	https://portail.polytechnique.edu/cmap/fr
Research Group	Defi Team, http://www.cmap.polytechnique.fr/~defi/
Internship Supervisor	Jing-Rebecca Li, http://www.cmap.polytechnique.fr/~jingrebeccali/
Internship Subject	Partial differential equations for diffusion MRI modeling
Student's level	<input type="checkbox"/> Advanced Undergraduate Students (3 rd or 4 th year) <input checked="" type="checkbox"/> Master's students (1 st or 2 nd year) <input checked="" type="checkbox"/> PhD students
Proposed Duration	<input type="checkbox"/> 3 months <input checked="" type="checkbox"/> 4 months <input type="checkbox"/> 5 months <input type="checkbox"/> 6 months
Prerequisites	Knowledge of PDEs, finite elements, Matlab.
Internship description (max. 15 lines)	<p>SpinDoctor is a software package that performs numerical simulations for diffusion magnetic resonance imaging for prototyping purposes. It solves the Bloch-Torrey equation, which is a diffusive PDE, to obtain the diffusion MRI signal. The PDE is solved by P1 finite elements combined with built-in Matlab routines for solving ordinary differential equations. The finite element mesh generation is performed using an external package called Tetgen. The intern will help to formulate a new representation of the diffusion MRI signal based on Fourier series. The intern will test the resulting new numerical algorithm and study the effects of the Fourier periodicity box size and the number of Fourier modes on the quality of the signal approximation. If the intern makes good progress during the internship, we expect to submit the results for publication as a scientific article.</p> <p>Software, see https://github.com/jingrebeccali/SpinDoctor Publications, see https://arxiv.org/abs/1902.01025 and https://arxiv.org/abs/1911.07165</p>