PUSHING DIFFUSION MRI BEYOND ITS LAST 30 YEARS

Dr. ALEXIS REYMBAUT
UNIVERSITÉ DE SHERBROOKE

ABSTRACT

Probing the diffusion patterns of water molecules in the brain with magnetic resonance imaging (MRI) is a state-of-the-art modality indirectly characterizing the integrity and organization of white-matter pathways. However, the interpretation of diffusion MRI data, often performed through the use of diffusion tensor imaging (DTI) [1], is profoundly biased. Indeed, DTI averages the relevant diffusion patterns on a millimeter scale whereas the brain's biological structures are typically micrometer-sized. This explains why the clinical use of diffusion MRI has not expanded much in the past 30 years. To overcome this limitation, two main families of solutions can be explored: either acquiring data through a set of acquisitions yielding complementary pieces of diffusion information or analyzing typical diffusion data with a complex modeling scheme. After introducing advanced members of each family, namely b-tensor encoding and the DIAMOND model, I will explain how I combine them in a single framework: the Magic DIAMOND model. I will finally discuss promising alternatives that serve the same goal: putting an end to diffusion MRI’s core limitations.

BIO

After studying fundamental physics in France, Alexis Reymbaut obtained his PhD in theoretical quantum physics from Université de Sherbrooke. The heavy outreach experience he also acquired during his PhD finally led him to yearn for a more multidisciplinary field of research: theoretical bio-imaging. Specializing in the development of innovative methods and models for diffusion MRI in Pr Maxime Descoteaux’s group at Université de Sherbrooke, Alexis Reymbaut will soon leave for Sweden for a second post-doctorate to further refine his specialty.

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Dr. Christine Tardif (christine.tardif@mcgill.ca)  Dr. Sebastian Wachsmann Hogiu (sebastian.wachsmannhogiu@mcgill.ca)