22nd World Congress of Pshychophysiology. Kraków, Poland

Workshop on Diffusion MRI of the brain, July 8th 2025

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Abstract

Diffusion magnetic resonance imaging (MRI) has gained much interest from the neuroimaging community over the last two decades due to its ability to analyze in vivo structures within the white matter of the brain. The current trend in diffusion MRI analysis is the calculation of increasingly advanced quantitative metrics focused on subtle aspects of the diffusion and brain microstructure.

This workshop will:

- Provide a theoretical introduction to diffusion MRI and reviews the state-of-the-art diffusion MRI methods of the brain, including **Diffusion Tensor Imaging** and **Free-Water Imaging**.
- Discuss recent advances in diffusion MRI techniques beyond the standard Diffusion Tensor Imaging and capable of handling more sophisticated data acquisition schemes, including a higher number of shells (b-values) and higher number of samples per shell, such as the **AMURA, MiSFIT or HYDI-DSI-QP**.

This workshop will consist of a theoretical introduction and a practical hands-on programming session in MATLAB (so at least basic knowledge of MATLAB is recommended). Hands-on session will be focused on selecting appropriate diffusion MRI technique for your data, handling the data and estimating quantitative metrics from in vivo brain scans. The attendees should bring their own laptops with preinstalled MATLAB.

Contents of the hands-on session

BEFORE WE BEGIN: Make sure the current folder, where the scripts for the Workshop are lcoated, are always accessible (Click anywhere in the code box and press *Ctrl+ENTER* to run all the code in this section).

```
addpath(pwd);
```

1. A brief introduction to the dmrimatlab toolbox
2. A brief overview of MRI-related data sets
3. Basic Diffusion Tensor Imaging with dmrimatlab
4. Advanced Diffusion Tensor Imaging: Free-Water Volume Fraction Elimination
5. Advanced modeling of diffusion MRI: non Gaussian signal representations
6. Representation of diffusion MRI data: color coding, glyphs, tractography and beyond