Contribution ID: **5**   Type: **Hands-on session**

Mapping cortical microstructure from in vivo MRI using FreeSurfer

Monday 27 October 2025 11:00 (1h 30m)

Quantifying and visualizing the structure of the cortex along its layers and across its depth can reveal architectonic boundaries between different cortical regions.

One approach to such analysis is constructing cortical surfaces, i.e, the inner (white matter) and outer (pial) borders of the cortical sheet.

The surfaces provide an easy way for sampling and analyzing MRI data at different locations in the cortex, and allow for surface-based registration across subjects for group studies.

In this session, I will cover some of our recent efforts to study the geometrical determinants of layer placement in the cortex as well linking the layers and histological data.

The practical part will demonstrate how to generate layer models, map MRI data onto the layers at different depths and visualize it, how to transform the data to average space, and how to map it to existing atlases such as the BigBrain.

Requirements:

- Freesurfer (either 7.4.1 or 8.1.0)
- A python environment (python version >= 3.11) where you can install dependencies
- Data and notebooks for this session will be available [here]

Speaker

Oula Puonti is a senior researcher at the Danish Research Centre for Magnetic Resonance with a background in computer science and medical image analysis.

His research focuses on developing open source computational tools to analyze brain structures from a wide variety of MRI scans ranging from high-resolution scans acquired with ultra-high field scanners to low-resolution clinical scans.

The tools Oula has helped develop are incorporated into widely used software tools for brain image analysis (FreeSurfer) and biophysical modeling of the whole head (SimNIBS).

Oula's recent focus has been on modeling the cortical laminae from ex vivo data and applying these models to in vivo scans.

Presenter: Dr PUONTI, Oula (Danish Research Centre for Magnetic Resonance)

Session Classification: Hands-on Session 1