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# Indirect network disconnection methods

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Measuring behaviour and MRI signals to measure network-level dysfunction in patients complex, costly, and not easily implemented in clinical practice.

A possible solution to this problem has come in the last few years from the development of large databases of functional and diffusion MRI data, along with analytical pipelines for generating so-called 'connectomes', i.e. the ensemble of functional or structural connections among brain regions that are common in a large group of healthy subjects.

One method, known as 'lesion network mapping', computes whole-brain functional connectivity (FC) from the lesion by embedding the damaged brain region of a specific patient into the normative functional connectome, estimating which regions are connected to the site of damage. This functional map can serve as a proxy for network-level FC abnormalities caused by the lesion (functional disconnection, FDC). This method has been applied in several studies to investigate network dysfunction across a range of neurological and psychiatric conditions.

A similar method estimates structural disconnections from clinical structural MRI lesions. As for the functional disconnectivity maps, the lesion of patients is embedded into the normative structural connectome, that is a probability map of normal white matter tracts measured with advanced diffusion imaging protocols. In a structural disconnection (SDC) map, each voxel in the brain indicates the probability of structural disconnection caused by the lesion to healthy white matter tracts.

Similar approaches have been proposed for estimating indirect metrics of network damage requiring only clinical structural imaging in focal disorders (stroke, tumor), such as tract density index (TDI). This measure estimates the number of fibers damaged by a brain lesion.

In this session we will provide a general framework and a hands-on session to obtain structural and functional disconnection maps and tract density index from clinical MRI data.

- **Theory:** Applications, opportunities and limits of indirect disconnectivity approaches
- **Hands on:** How to obtain maps of structural and functional disconnection

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