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Anatomical connectivity networks of the human brain

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Systeemianalyysin
laboratorio

Background

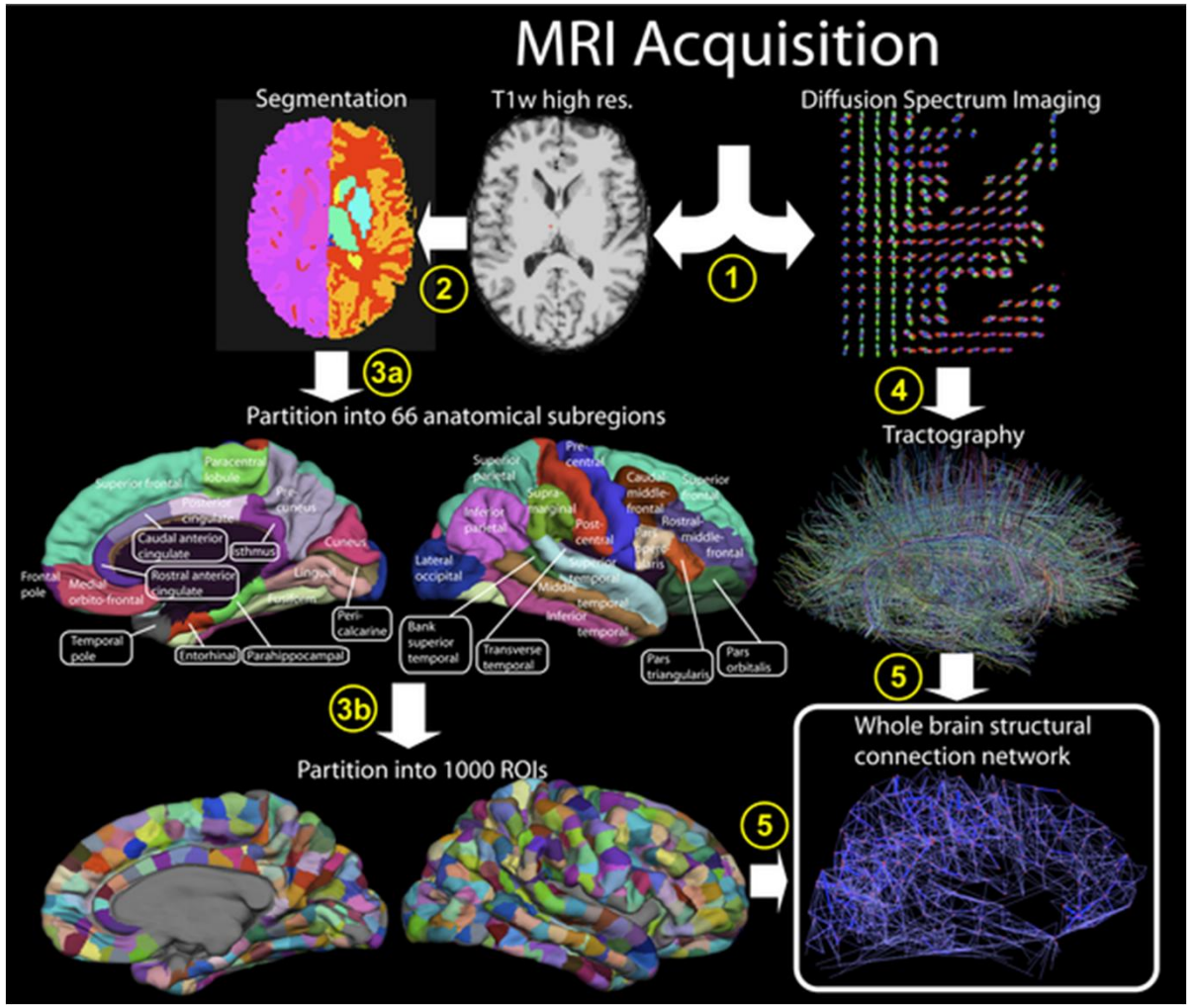
- The human brain is a large complex interconnected system
- Brain consist of neurons (gray matter) and myelinated axons (white matter)
- Recently it has become possible to map the anatomical connectivity patterns of the human brain in vivo

Goal

- Construction of cortical anatomical networks from preprocessed Diffusion Tensor Imaging (DTI) data
- Analyzing these brain tractography networks by using complex networks tools
- Construct networks from preprocessed functional Magnetic Resonance Imaging (fMRI) data
- Analyzing these functional networks using complex networks tools

Methods

- DTI is a technique to detect the white matter tracts by observing the diffusion of water in the brain
- First part is to divide the brain into small areas (region of interest, ROI) and then compute the fiber density between the areas → weighted network
- Second part is to analyze the network using complex networks tools
- Compare network properties within the datasets
- Comparing global graph properties of the networks of the different datasets and see if there is similarities



Hagmann, Cammoun, Gigandet, Meuli, Honey, Wedeen, Sporns:
Mapping the Structural Core of Human Cerebral Cortex (2008)

Methods

- FMRI measures brain activity by detecting changes in blood flow
- Calculating correlation between timeseries of different regions → weighted network
- Comparing graph properties of graphs made of DTI and fMRI data for same subjects
- Tools: Pipeline for Analysing braiN Diffusion imAges (PANDA), MATLAB, NetworkX (python library)

References

- Yan C, Gong G, Wang J, Wang D, Liu D, Zhu C, Chen ZJ, Evans A, Zang Y, He Y: Sex- and brain size-related small-world structural cortical networks in young adults: a DTI tractography study (2010)
- Decoding Emotions -project of Aalto university's Brain and Mind Laboratory
- Alexander Leemans (http://www.isi.uu.nl/People/Alexander/)

Schedule

- Introduction of the subject: 21.1.2013
- Gathering material and studying, computing the models 06/2012-10/2012
- Writing 10/2012 - 1/2013
- Introduction of the finished work 25.3.2013