Lecture:
- Einführung in die Akquisition und Auswertung von MRT-Daten -

- Introduction to the Acquisition and Analysis of MRI Data -

Summary:
This lecture series is a comprehensive introduction to various tools for analyzing Magnetic Resonance Imaging (MRI) data. It starts with an introduction to the operating system Linux which is frequently used on IT systems in scientific environments.

Target audience and prerequisites:
The lecture series is open to everybody who wants to learn about MRI data analysis. Importantly, there are no prerequisites.

Language:
English or German, as requested by the audience.

Place and Time:
In presence: Seminar area of the Brain Imaging Center, Schleusenweg 2-16, Building 95H, Campus Niederrad; Time: will be announced.
Online (if requested or if lectures in presence are not possible): Links will be sent to registered participants.

Script:
The lecture material can be made available to registered participants.

Registration:
Via E-Mail to Prof. Dr. Ralf Deichmann <Deichmann@med.uni-frankfurt.de>

Overview of the different parts:

Linux 1
0. Important Keys on your Keyboard
1. The Linux Shell
2. Working with directories
   2a. The Linux File System
   2b. Orientation and Moving in the Directory Tree
   2c. Create, Rename, Move, Copy, Remove Directories
   2d. Listing the Directory Contents
   2e. Using Wildcards

Linux 2
1. Working with Files
   1a. How to rename, move, copy and delete files
   1b. How to get information on files
   1c. How to read from a text file
   1d. How to write into a text file
   1e. How to get the size of files/directory contents
2. Searching for Files
3. Concatenating Commands: The "pipe"
4. Access Rights

Linux 3
1. Avoid unnecessary typing!
2. Stopping a Process
3. Shell Variables
4. Shell Scripts: Motivation
5. Coding and running a simple shell script

Linux 4
1. Text Editing Tools: General
2. The command "sort"
3. The command "sed"
4. The command "awk"

Linux 5
1. Calling a shell script with arguments
2. "if" statements in shell scripts
3. "while" loops in shell scripts
4. Interrupting/Skipping parts of a loop
5. "for" loops in shell scripts
6. "case" statements in shell scripts

Linux 6
The "vi" Editor

Image Formats
1. The DICOM and the NIfTI format
2. Converting DICOM into NIfTI
3. Viewing NIfTI data with MRICRON
4. Reading NIfTI data into Matlab

Calculations with MR images using FSL
1. fslmaths: Introduction
2. Exploring longitudinal relaxation
3. Exploring transverse relaxation
4. Analyzing image time series
5. Analyzing DTI data

Segmentation using FSL
1. Introduction: What is "Brain Extraction", "Nonuniformity Correction" and "Segmentation"?
2. Brain Extraction using "bet"
3. Nonuniformity Correction and Segmentation using "fast":
   - T1-weighted data with low signal bias
   - T1-weighted data with strong signal bias
   - T2-weighted data
4. Creating binary tissue masks with "fslmaths"

Coregistration and Normalization using FSL
1. Introduction: What is Coregistration ?
2. Coregistration of example data using "flirt"
   - Coregistration of congruent and non-congruent data
   - Application of existing coregistration matrices
   - Inversion and concatenation of coregistration matrices
   - When coreg. fails: a trick to improve results
   - Coregistration of binary masks
   - Resampling data with a different spatial resolution
3. Introduction: What is Spatial Normalization ?
4. Normalization of example data using "fnirt"

Distortion Correction of EPI Data using FSL
1. Introduction: Distortions of EPI Data
2. General: The Field Mapping method
3. General: The TOPUP method
4. Performing the Field Mapping method in FSL
5. Performing the TOPUP method in FSL

Creating Plots with Matlab
1. Creating 2D-Plots
2. Creating 3D-Plots

DTI Data Analysis with FSL - Part 1
Provided by Dr. Manoj Shrestha

DTI Data Analysis with FSL - Part 2
Provided by Dr. Manoj Shrestha