

**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 CoBIC, Heinrich-Hoffmann-Str. 9, Building 88, 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>

**(see next pages for an overview of the lecture series)**

## Overview of the different parts:

### 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

## **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