COURSE OUTLINE

Course: RADI 6051 Statistical Parametric Mapping
Instructors: Jack L. Lancaster
Text: Functional MRI an introduction to methods
             Peter Jezzard, Paul M. Matthews, and Stephen M. Smith,
Schedule: eds. Fall, TU-TH 2:00-3:30
Where: RIC Library 2.610

Functional MRI (fMRI) is a 4-D study of the brain with the 4th dimension being time. Temporal changes in brain activity modulate the time course of an fMRI signal, and the objective of fMRI studies is to determine the strength and location of such brain activity and present these findings as a 3-D statistical parametric map (SPM). This introductory course provides an overview of MRI physics relevant to fMRI including the physiological basis of fMRI signal production. Guidelines for designing fMRI studies using common paradigms will be presented and example studies detailed. Special emphasis will be placed on image processing steps essential to extract meaningful information from fMRI studies. Statistical detection theory and statistical analysis approaches specific to fMRI will be presented. Numerous fMRI studies will be detailed and software (FSL) for statistical parametric mapping demonstrated along with software (Mango) used to visualize and analyze fMRI studies.

Introduction to Statistical Parametric Mapping (JLL)

1. Introduction to Coordinate Systems and More
2. Mango Image Processing Overview
        - ROIs, Transforms, 3D surfaces, etc.

Physics of MRI (JLL)

1. Principles of nuclear magnetic resonance and MRI –   Ch 3
2. Quantitative measurements using fMRI –   Ch 8
3. Hardware for fMRI –   Ch 5
4. Spatial and temporal resolution of fMRI –   Ch 7
5. Selection of the optimal pulse sequence for fMRI –   Ch 6
        Mango – layouts, cine, 3D surfaces
6. Ultra-fast MRI   Ch 4

Special Project

Experimental Design

1. Effective paradigm design
2. Stimulus presentation and response monitoring

Analysis of fMRI

1. Overview of fMRI analysis (JLL)

2. Preparing fMRI data for statistical analysis (JLL)
3. Head motion correction (JLL)
4. Statistical Analysis (JLL)

fMRI applications

1. Cognitive neuroscience
2. Potential clinical uses (JLL)

Final Project