2021-2022

**222.4127 – Introduction to functional MRI analysis Semester A**

**Time: Tuesday 10:00-14:00**, IIPDM, conference room / computer room

**Instructor:** Dr. Avi Mendelsohn, **Email:** amendels1@univ.haifa.ac.il

**Office Hours:** Tuesday 14:00-16:00, Room 160, IIPDM, 04-8249054

**Teaching Assistants & Office Hours:** None

**Course Level:** (MA / PhD)**:**

**Course Type & Format:** Elective,Lecture + computer assignments

**Number of Hours/Credits: 4**

**Prerequisites:** None

**Course Overview (Short Abstract):**

The course is designed to convey the principles of functional MRI, and aims at providing the students with theoretical understanding and hands-on expertise in data analysis.

**Learning Outcomes (What are the skills, abilities, or major concepts a student is expected to acquire in this course?) – At the end of the course students will be able to:**

1. Learn the principles, signal meaning, experimental design, and statistical analysis of functional MRI.

2. Perform functional MRI analysis using Matlab-based toolboxes.

3. Be acquainted with contemporary literature of fMRI experiments.

**Assessment (Assessment Method and Grade Composition):**

Homework assignments – 20%

Final assignment – 80%

**Week-by-Week Content and Assignements :**

|  |  |  |
| --- | --- | --- |
| **Week #** | **Topic** | **Assignment** |
| 1 | Introduction to MRI, the basics of MRI physics |  |
| 2 | Introduction to Matlab and Statistical Parametric Mapping (SPM) software |  |
| 3 | The Blood-Oxygenated-Level-Dependent (BOLD) signal, source and meaning |  |
| 4 | Preprocessing of fMRI data | Home assignment – preprocessing of new data |
| 5 | General Linear Model (GLM) analysis, multiple regression |  |
| 6 | Statistical maps of contrasts and F-tests |  |
| 7 | Parametric modulation and model-based fMRI |  |
| 8 | Regions of interest (ROI) analysis | Home assignment – first-level analysis (GLM) |
| 9 | Group-level (second-level) analysis |  |
| 10 | Functional connectivity, seed-based correlations and psychophysiological interaction (PPI) |  |
| 11 | Advanced fMRI analysis I, classification analysis |  |
| 12 | Advanced fMRI analysis II, Support Vector Machines (SVM) |  |
| 13 | Batch processing and script programing |  |
| 14 | Graph theory approaches and summary | Final assignment |

**Website:** Dedicated Moodle site

**Reading List:**

1. Functional Magnetic Resonance Imaging, 2014, Huettel, Song, & McCarthy.
2. Matlab for Brain and Cognitive Scientists, 2017, Cohen.
3. Statistical Analysis of fMRI Data, 2011, Ashby.