RADI 6051 - Statistical Parametric Mapping
(Provides credit for RADI 6019 – Medical Image Processing)

Fall 2017

CLASS DAYS and TIME: Tuesday/Thursday 2:00-3:30 PM

CLASSROOM: Research Imaging Institute (RII) Library - Room 2.610

COURSE FACULTY: Jack L. Lancaster, Ph.D., Course Director

OFFICE LOCATION and HOURS: RII Room 2.412 (by appointment)

EMAIL: jlancaster@uthscsa.edu

TELEPHONE: 210-567-8188

READ THIS DOCUMENT CAREFULLY - YOU ARE RESPONSIBLE FOR ITS CONTENTS.

COURSE DESCRIPTION AND OBJECTIVES

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 fMR 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. 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 FSL software (http://www.fmrib.ox.ac.uk/fsl/) used for statistical parametric mapping and Mango software (http://ric.uthscsa.edu/mango/) used to visualize and analyze fMRI studies.

Pre-requisites – RADI 5015 Physics of Diagnostic Imaging I and or RADI 6015 Physics of Diagnostic Imaging II recommended

Semester credit hours – 3-hr course

By the end of this course, each student should be able to:

- Apply the basic principles of statistical parametric mapping to fMRI studies
- Create statistical parametric maps from fMRI studies using the FSL software
- Use the MANGO image processing software to analyze and visualize statistical parametric maps

COURSE ORGANIZATION

The main teaching modalities used in this course include:

1) Classroom lectures are supported by slides and computer based demonstrations

2) Homework assigned for each week's lectures

3) Hands on use of software designed for statistical parametric mapping and visualization

Materials – Student's laptop computer. No additional materials required.

Computer Access – The FSL and Mango software will be downloaded, and these are available for Windows, Macintosh,

and Linux operating systems. Dropbox will be used to provide images for homework assignments.

Reading Assignments – Most lectures are keyed to chapters in the textbook. Reading materials for other lectures will be provided using Dropbox and students notified by e-mail.

ATTENDANCE

Students are expected to attend all class lectures. Absences can be excused by permission of course director.

TEXTBOOKS

Required: ***Functional MRI an introduction to methods***. Peter Jezzard, Paul M. Matthews, and Stephen M. Smith, eds.

Recommended: Most materials will be covered in the textbook, and additional reading materials will be provided for downloading using Dropbox.

GRADING POLICIES AND EXAMINATION PROCEDURES

Each homework assignment will be graded based on its point value (e.g. 8/9) and the final homework grade will be based on summed points achieved divided by summed points assigned. This will be converted to a 0-100% score for the homework grade.

The final exam will be a paper written in the format of a journal article (example will be provided). The topic must relate to course materials.

Class participation will be based equally on attendance and active participation in classes.

Grading System

Homework - 70%

Final Exam – 20%

Class Participation – 10 %

The following a grading scale is used to determine final grades:

A = 90-100% B = 80-89% C = 70-79% F = < 69%

REQUESTS FOR ACCOMODATIONS FOR DISABILITIES

In accordance with policy 4.2.3, **Request for Accommodation Under the ADA and the ADA Amendments Act of 2008 (ADAAA)**, any student requesting accommodation must submit the appropriate request for accommodation under the American with Disabilities Act (ADA, form 100). to his/her appropriate Associate Dean of their School and a copy to the ADA Coordinator. Additional information may be obtained at http://uthscsa.edu/eeo/request.asp.

ACADEMIC INTEGRITY AND PROFESSIONALISM

Any student who commits an act of academic dishonesty is subject to discipline as prescribed by the UT System Rules and Regulations of the Board of Regents. Academic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an exam for another person, signing attendance sheets for another student, and any act designed to give unfair advantage to a student or the attempt to commit such an act. Additional information may be obtained at http://catalog.uthscsa.edu/generalinformation/generalacademicpolicies/academicdishonestypolicy/

TITLE IX AT UTHSCSA

Title IX Defined:

Title of the Education Amendments of 1972 is a federal law that prohibits sex discrimination in education. It reads "no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance."

University of Texas Health Science Center San Antonio's Commitment:
University of Texas Health Science Center San Antonio (UTHSCSA) is committed to maintaining a learning environment that is free from discriminatory conduct based on gender. As required by Title IX, UTHSCSA does not discriminate on the basis of sex in its education programs and activities, and it encourages any student, faculty, or staff member who thinks that he or she has been subjected to sex discrimination, sexual harassment (including sexual violence) or sexual misconduct to immediately report the incident to the Title IX Director.

In an emergency, victims of sexual abuse should call 911. For non-emergencies, they may contact UPD at 210-567-2800. Additional information may be obtained at http://students.uthscsa.edu/titleix/

EMAIL POLICY

Homework assignments will be sent to the class as group e-mail. Students will return homework to the course director by e-mail before the close of day its due. For late homework the grade will be dropped 10% per day up to 30%. The preferred format for students' homework results is a pdf file.

USE OF RECORDING DEVICES

Both audio and video recordings of the class lectures are permitted for those that are unable to attend class.

ELECTRONIC DEVICES

Each student should bring their laptop computer to class. Class demonstrations can be repeated on students' laptops to verify that they understand methods.

TENTATIVE CLASS SCHEDULE

RADI 6051 - Statistical Parametric Mapping

Fall 2016

All classes will be a combination of lecture and demonstrations

WEEK	DATE	TOPIC	Assignment	Instructor and Modality
Week 1	18 Jul	Principles of NMR and MRI	Chapter 3/ Mango software	JLL
	20 Jul	Hardware for fMRI	Chapter 5	
Week 2	25 Jul	Selection of pulse sequences for fMRI	Chapter 6	JLL
	27 Jul	Quantitative Measurements in fMRI	Chapter 8	
Week 3	1 Aug	Spatial & temporal resolution of fMRI	Chapter 7	JLL
	3 Aug	"	"	
Week 4	8 Aug	Ultra-fast MRI	Chapter 4	JLL
	10 Aug	Review of MRI	Chapters 3-8	
Week 5	15 Aug	Effective paradigm design	Chapter 9	JLL
	17 Aug	The scanner as a psychophysical lab	handout	
Week 6	22 Aug	fMRI practices at the RII	slides	JL
	24 Aug	Overview of fMRI analysis	Chapter 11	
Week 7	29 Aug	The General Linear Model (GLM)	Handout/ FSL software	JLL
	31 Aug	"		
Week 8	5 Sep	Preparing fMRI for statistical analysis	Chapter 12	JLL
	7 Sep	"		
Week 9	12 Sep	Head motion and correction	Chapter 13	JLL
	14 Sep	Demo FEAT for fMRI processing		CF
Week 10	19 Sep	File formats DICOM/ NIfTI/ des	Handouts	JLL
	21 Sep	"		
Week 11	26 Sep	Reference frames for the brain	Handouts	JLL
	28 Sep	Talairach/MNI/other		
Week 12	3 Oct	Affine transforms	Handouts	JLL
	5 Oct	Jacobian determinant		
Week 13	10 Oct	Diffusion Tensor Imaging (DTI)	Handouts	JLL
	12 Oct	"		
Week 14	17 Oct	Registration, brain atlases,	Chapter 15	JLL
	19 Oct	and cortical flattening		
Week 15	24 Oct	FEAT: single session & advanced single-subject analyses	Handouts	JLL
	26 Oct	FEAT: fMRI group analysis		
Week 16	31 Oct	Independent Component Analysis	Handouts	JLL
	2 Nov	(ICA) using MELODIC & FSLmaths		
Week 17	7 Nov	PET brain imaging	Handouts	JLL
	9 Nov	PET SPM examples		

JLL – course director JL – Jon Li MRI technical support CF – Crystal Franklin data analysis