

(Note: This version of the syllabus is uploaded at the beginning of the semester; hence, it is tentative. Updated to reflect Hurricane Harvey - related closure of UHCL.)

CENG 5931 COURSE SYLLABUS

COURSE: CENG 4331.05 Medical Imaging Data Analysis

COMPUTER NO: N/A

SEMESTER: Fall 2017

CLASS LOCATION: UH-Clear Lake, Delta 136

CLASS MEETING TIMES: Wednesdays 7:00-9:50pm

INSTRUCTOR: Unal "Zak" Sakoglu, PhD

MESSAGES: Phone: 281-283-3813

E-MAIL: *mylastname at uhcl dot edu*

FAX: 281-283-3870

URL: <http://sce.uhcl.edu/sakoglu>

Office Secretary at Delta Annex (Ms. Jsaniese Parham): 281-283-3815

Faculty Suite Secretary (Ms. Tara Boyd): 281-283-3850

OFFICE HOURS OF THE INSTRUCTOR: Mondays & Wednesdays 3:15pm-4:30pm.

Other days may be possible but by appointment only.

Instructor's Office Location: Delta Annex Building (DA) Room #8.

When you email me, please put "CENG 5931" in the subject line.

Feel free to just stop by during my office hours, the office hours are for you. But it wouldn't hurt if you could still go ahead and email me stating that you would stop by. Occasionally, I may have meetings that may overlap with the office hours. In those cases I will try to inform you in advance to my best ability.

Teaching Assistant (TA) Info: TBA (if & when one will be available). TA Office Hrs: TBA.

COURSE DESCRIPTION: Applications of signal and image processing, statistics, time-series analysis, and pattern recognition & classification, machine learning techniques to process and analyze mainly functional medical imaging data will be introduced. Functional medical imaging data, focused mostly on brain imaging, such as electroencephalography (EEG), functional magnetic resonance imaging (fMRI), will be included. Hands-on applications of the aforementioned techniques to real medical imaging data will be done via projects using MATLAB.

COURSE PREREQUISITES: Basic knowledge of statistics, signal processing and MATLAB, and instructor's approval.

TEXTBOOKS & MATERIALS REQUIRED:

Main: Functional Magnetic Resonance Imaging, 3rd Edition. 2014. Sinauer. ISBN: 978-0-878936274. Authors: Scott A. Huettel, Allen W. Song, Gregory McCarthy.

Supplementary: Computing Brain Activity Maps. 2007. Cambridge. ISBN: 0-521-86826-2 or 978-0-521868266. Author: Gordon E. Sarty.

Other reading materials, papers, etc. will be provided by the Instructor.

MATLAB: An investment in the Student Edition of MATLAB is worthwhile. The program will be useful to you throughout your career. In any case, the workstations in the Delta Lab have MATLAB. www.mathworks.com

METHODOLOGY: Lectures, quizzes/tests, and hands-on project(s) using MATLAB.

A **Blackboard Course Shell** is set up and utilized to post HW/project assignments, course slides, notes, announcements, etc. Follow my announcements in the class about it.

Course Learning Outcomes:

1. Students will be able to pros and cons of different medical imaging techniques including MRI, fMRI, PET, CT, EEG.
2. Students will process and analyze MRI/fMRI data and interpret results.

- Students will successfully apply machine learning / pattern classification to medical imaging data.
- Students will learn how to present their project results by writing a report and doing a presentation.

Course Outline: This schedule and syllabus is tentative. You will be informed of any changes.

Please notify me if you see something on the syllabus that doesn't make sense (e.g. dates wrong, etc?).

(Note: The schedule is updated to reflect the closure of the university the first week due to hurricane Harvey)

Wk	Dates [*] ^{**}	Subject	Project-related Activities
1	W Aug. 30	The university is closed due to hurricane Harvey and the subsequent storms/floods which affected Houston area. Be safe.	
2	M Sept. 4 W Sept. 6	Labor Day — No Class or office hours. Going over the course, the syllabus, MATLAB, Introduction of Medical Imaging, MRI scanners and fMRI. (Huettel Chapters 1&2; Sarty Chp 1)	
3	W Sept. 13	Principles of MR signal generation and formation. (Huettel Chapters 3&4)	I will make projects available later this week.
4	W Sept. 20	Basics of MRI Contrast Mechanisms and Acquisition Techniques; Basics of Neuronal & Hemodynamic Activity (Huettel Chps 5&6)	We will discuss the projects in more detail. I will assign teams of 2-3 students each. Teams will select their projects.
5	W Sept. 26	BOLD fMRI (Huettel Chp 7)	Project selections have to be finalized by teams by the end of Sept 26.
6	W Oct. 4	Signal, Noise, And Preprocessing of Data (Huettel Chp 8, Sarty Chp 2)	Teams working on projects. Each team will give a 3-5 minutes verbal update on the project status.
7	W Oct 11	Experimental Designs (Huettel Chp 9, Sarty Chp 3)	Teams working on projects. Each team will give a 3-5 minutes verbal update on the project status.
8	W Oct. 18	Basic Statistical Analysis (Univariate, Regression, GLM, Activation Maps). (Huettel Chp 10, Sarty Chp 4)	Teams working on projects. Each team will give a 3-5 minutes verbal update on the project status.
9	W Oct. 25	Advanced Statistical Analysis (Multivariate, PCA, ICA, Clustering, FC, Pattern Classification) (Huettel Chp 11, Sarty Chp 5, & other reading material)	Teams working on projects. Each team will give a 6-8 minutes verbal update on the project status.
10	W Nov. 1	FC and Dynamic FC Analysis Methods (Huettel Chp 11 and Sarty Chp 5 continued; papers by Sakoglu <i>et al.</i>) This week or the next, we may have a brief in-class test, to test your fundamental knowledge about medical imaging data analysis	Teams working on projects. Each team will give a 6-8 minutes verbal update on the project status.
11	W Nov 8	Other Imaging Methods (TMS, ERP, EEG, MEG) and Their Basic Analyses (Huettel Chp 13)	Teams working on projects. Each team will give a 6-8 minutes verbal update on the project status.
12	W Nov. 15	Mid-term team project status presentations. Feedback will be given. Your projects should be at least 50% complete.	Each member of the group takes turns to present. 20 mins per team.
13	W Nov. 22	Happy Thanksgiving! No Class or office hours today.	
14	W Nov. 29	Practical and Ethical Issues of Brain Imaging (Huettel Chp 14). Project-based analysis methodologies discussed.	Start finalizing your project and start writing your project report (one report per team, each team member contributes). Verb. updates (10 mins)
15	W Dec. 6	Project-based analysis methodologies will be discussed; I will give feedback. Final tweaks on your projects. Test.	Finalizing your project and finish writing your project report. Email me draft reports and presentations by Dec 4 th 4pm so that I can give proper and timely feedback.
16	W Dec. 13	Final Presentations between 7-10pm 30 mins per team. Final team project presentations. (University final exam schedule: https://public.uhcl.edu/academics/resources/academic-calendar/final-exam-schedule)	All reports and presentations are due, emailed to me by Monday, Dec 11 th 4pm.

* We will try to arrange for a make-ups with consensus for any missed dates if I have to travel for a conference, seminar talk, etc.

** Other important dates: Sept 13 is census day; Nov 13 is last day to drop/withdraw. But visit <https://public.uhcl.edu/academics/resources/academic-calendar/> for UHCL's academic calendar for the most up-to-date important dates as some dates might change after the submission of this syllabus.

*** HWs' quantity, scheduling, due dates may change. All tentative. I will do my best to stick to the above plan. Individual HW deadlines will be stated on each HW's instructions.

ATTENDANCE POLICY: Attendance in class is expected and you should understand that classroom participation is an important element in the learning process. Students are encouraged to ask questions and make comments. An absence from class does not excuse students from tests and assignment deadlines. **The instructor would appreciate an email message from students who are not going to attend class for whatever reason.**

GRADING POLICY: The grading policy of this course will follow the grading system as outlined in the current Catalog of the University of Houston-Clear Lake. In an effort to fairly assign letter grades according to the student's final average, usually there will not be a curve. Instead the following grading policy will hold:

A : 93-100%	C : 73-76.99%
A-: 90-92.99%	C-: 70-72.99%
B+: 87-89.99%	D+: 67-69.99%
B : 83-86.99%	D : 63-66.99%
B-: 80-82.99%	D-: 60-62.99%
C+: 77-79.99%	F : 0-59.99%

After I announce the grades of an assignment, HW, exam, etc. you have one week to see your graded paper (during my office hours, or appointment via email, based on my availability). *I will give you usually 7-11 days for the assignments to be completed by you and then it takes about another 7-8 days to be graded and another couple of days for the grades to be announced, and if you do not see your graded paper within a week, it has already been 4 weeks since the assignment, and we all will almost forget about the questions.*

FINAL AVERAGES: Final averages will be determined by the following assignments and weighting*:

Tests	20%
Weekly Project Progress Reports	10%
Mid-term Project Presentation	20%
Final Project Report & Presentation	40%
Attendance, Participance, Popquizzes	10%

*I may change these weights slightly if I see it as necessary for some reason such as the students are disproportionately underperforming in any of the above assignments/items, in that case I will notify you of the new weights.

Honesty Policy: Every student is expected to follow the honesty policy as described in the catalog. The first honesty violation will result in a grade of 0 on the assignment or test. The second honesty violation will result in a grade of F for the course. Students must remember the honesty pledge on all exams, as a reminder of the honesty code. Note that copying solutions verbatim or almost verbatim from a solutions manual or from instructions solutions, or from other or previous students are all considered cheating. You have to provide your own solutions. Academic Honesty Code is available at www.uhcl.edu website.

American Disabilities Act (ADA)

If you will require special academic accommodations, please contact the UHCL [Disability Services Office](#) at 281-283-2627.

The University of Houston System complies with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, pertaining to the provision of reasonable academic adjustments/auxiliary aids for students with a disability. In accordance with Section 504 and ADA guidelines, each University within the System strives to provide reasonable academic adjustments/auxiliary aids to students who request and require them.

If you believe that you have a disability requiring an academic adjustments/auxiliary aid, please contact your University's student disability services center.

Drop Rule Limitation

Students who entered college for the first time in Fall 2007 or later should be aware of the course drop limitation imposed by the Texas Legislature. Dropping this or any other course between the first day of class and the census date for the semester/session does not affect your 6 drop rule count. Dropping a course between the census date and the last day to drop a class for the semester/session will count as one of your 6 permitted drops. You should take this into consideration before dropping this or any other course. Visit www.uhcl.edu/records for more information on the 6 drop rule and the census date information for the semester/session.

Updated 10/23/2017