

Note: This syllabus is tentative.

CENG 5631 COURSE SYLLABUS

COURSE: CENG 5631-01 Digital Image Processing

SEMESTER: Spring 2019 (1/22/2019 – 5/13/2019)

CLASS LOCATION: UH-Clear Lake, D136

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

INSTRUCTOR: Unal "Zak" Sakoglu, PhD

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OFFICE HOURS OF INSTRUCTOR: TBA.

When you email me, put "CENG 5631" 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 email me in advance 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, and there should be a notice on my office door.

Teaching Assistant (TA) Info: TBA,

TA Office Hours: TBA

COURSE DESCRIPTION: This course introduces the fundamental of digital images and emphasizes general principles of image processing. The course covers image acquisition, image sampling and quantization, intensity transformations and spatial filtering, filtering in the frequency domain, image restoration and reconstruction, color image processing, wavelet and multiresolution processing, image compression, morphological image processing, segmentation, image representation, and object recognition.

COURSE PREREQUISITES: *Knowledge of probability, linear algebra and linear systems.* **Also recommended:** Basic knowledge of MATLAB.

TEXTBOOK (required): Fundamentals of Digital Image Processing, RC Gonzales and RE Woods, 4th edition, Pearson, 2018. ISBN-13: 978-0-13-335672-4.

METHODOLOGY: Lectures, HW assignment with programming, term project, quizzes, tests, presentations. This course will be primarily delivered with in-class lectures. Some programming application assignments in MATLAB, will be included to reinforce the concepts. Numerous homework assignments will be assigned and graded. A term project will be assigned to apply and reinforce the information covered in the class. Pop-up quizzes may be utilized. Also, students will select a topic among the given topics, study, and present it at a scheduled time.

A **Blackboard Course Shell** will be set up and utilized to post HW/project assignments, course slides, notes, announcements, etc. So follow my announcements in the class about if/when the course shell will be created. You should login to the course shell daily.

Course Learning Outcomes:

1. Understand and present the key concepts and topics in digital image processing
2. Characterize the process to implement and test digital image processing and analysis algorithms and recognize ways to evaluate digital image processing and analysis systems
3. Apply and implement various digital image processing concepts to process and analyze various images by using a programming language such as MATLAB; experiment with digital image processing functions and libraries
4. Conduct and communicate a digital image processing project, i.e. propose a novel processing idea on an image dataset, design and execute processing to support the proposed idea and write a report about the project and present it.

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 and participate in the class discussions; it is also part of the grade. 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%

Course Outline

Not all of the material in the textbook's chapters will be covered. So it is important that you follow the class to track what exactly is covered and not covered.

Wk	Dates *,**	Subject (Ch. #'s from 4 th ed. of the textbook, Gonzales&Woods)	Notes***
1	T Jan. 22	Introduction, the course, syllabus, website(s) for data. Review of Probability, Random Variables, Linear Systems, Matrices and Vectors. (Ch. 1, Ch. 2 beginnings).	Start selecting a presentation topic, topics will be provided.
2	T Jan. 29	Digital Image Fundamentals (Ch. 2 continued)	Start selecting a term project.
3	T Feb. 5	Spatial Filtering and Transformations (Ch. 3)	Presentation topic selections finalized.
4	T Feb. 12	Filtering in the Frequency Domain (Ch. 4)	Project selections and teams finalized.
5	T Feb. 19	Image Restoration and Reconstruction (Ch. 5) Project Introduction Presentations	Project introductions presentation slides due 1pm of the class day.
6	T Feb. 26	Wavelets and Other Image Transforms (Ch. 6)	Verbal updates on project progress.
7	T Mar. 5	Color Image Processing (Ch. 7)	Verbal updates on project progress.
8	Week of Mar. 12	Spring Break – no class	Topic presentations start after the spring break. Topic presentation slides are due 1pm of the day of presentation.
9	T Mar. 19	Project Update Presentations 1 Image Compression and Watermarking (Ch. 8)	Project presentation slides due 1pm.
10	T Mar. 26	Image Compression and Watermarking (Ch. 8)-continued Morphological Image Processing (Ch. 9)	Verbal updates on project progress.
11	T Apr. 2	Morphological Image Processing (Ch. 9 -continued) Image Segmentation Fundamentals (Ch. 10)	Verbal updates on project progress.
12	T Apr. 9	Project Update Presentations 2 Image Segmentation Fundamentals (Ch. 10)	Project presentation slides due 1pm.
13	T Apr. 16	Feature Extraction from Images (Ch. 12)	Verbal updates on project progress.
14	T Apr. 23	Image Pattern Recognition and Classification (Ch. 13)	Verbal updates on project progress.
15	T Apr. 30	Final Project Presentations start	All final project presentation slides are due 1pm today 4/30.
16	T May. 7	Final Project Presentations (continued, if needed, during the final exam time) Final exam schedule: https://public.uhcl.edu/academics/resources/academic-calendar/final-exam-schedule	Project reports due May 7 th , 7pm.

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

** Other important dates: Visit <https://public.uhcl.edu/academics/resources/academic-calendar/> to double-check on UHCL's academic calendar for the most up-to-date important dates as some dates might change:

Census Day: Feb. 6, 2019. Last day to Drop/Withdraw: April 16, 2019. Last Day of Class: May 6, 2019.

Face-to-Face Final Exam Period: May 7 - May 13, 2019.

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

After I announce the grades of an assignment, HW, quiz, exam, etc. you have one week to see/review 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 them about another 7-10 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. So it is important that you review your paper promptly within one week of announcement of grades for maximize your learning in an efficient manner.*

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

Attendance, participation, possible quizzes and/or pop-quizzes	15%
HW assignments (includes MATLAB programming)	20%
Topic Study & Presentation	15%
Project (presentations, verbal updates, final presentation & final report)	50%
Bonus points possible for participation in a DIP-related research conference. Up to 10%	

*I may change these weights 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 promptly.

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.

HOMEWORK/ASSIGNMENT RULES

First read all instructions on the HW and follow them carefully, especially follow the specific deadline stated on the HW, HW size limit, etc. For project reports, I will upload a template/sample report.

A. -10 POINTS FOR EACH DAY LATE. There will be a final deadline after which the HW will not be accepted (We have to start grading all the HWs at some point and give you timely feedback.

B. For all Problems do these: (Points will be deduced if violated)

1. Briefly describe the problem to be solved before attempting the solution.
2. Show all work.
3. Turn in problems in order.
4. Make the results clear (Circle answers, explain results, etc.)
5. When an explanation of the results is requested, the numerical solution will not be sufficient.
6. If you copy/paste hand-written notes, make sure it is legible and make sure you crop unnecessary parts of the images and zoom-in properly. To avoid huge file sizes, use/save png or jpg format when you copy/paste, do not use bmp.

C. For Programming Problems, do these (points will be deduced if violated)

1. Write the equations/problems to be solved
2. Describe the solution method (flowchart, description, etc)
3. Comment the programming code
4. Turn in the code and the results (Plots, etc.), in order.

Be Neat – if I cannot read the solution – no credit!!

Digital Image Processing, 4th Edition

Rafael C. Gonzalez, University of Tennessee

Richard E. Woods, MedData Interactive

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(Note: Not all of the detailed content below will be covered in class, but mostly just the fundamentals)

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