Habib University
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Applied Digital Image Processing

CS 446 L1
Fall Semester 2022

Course Information

Class Location: C-015
Class Meeting Time(s): Sat (08:30 AM-09:45 AM)
Course Prerequisites: CS/CE 102/171,CS/CE 224/272
Hardware/Software Prerequisites (if any): Computer with mic, camera, and Internet connection
Content Area: This course fulfills the “CS Elective”, “SSE Elective” and “Free Elective” categories.

Instructor Information

Instructor: Muhammad Mobeen Movania
Title: Assistant Professor
Office Location: C-215 Faculty Pod C-203
Email: mobeen.movania@sse.habib.edu.pk
Office Hours: Wed: 10:00AM – 11:30AM, Fri: 9:00am-10:00am

Instructor: Faiza Azhar
Office Location: Faculty Pod C-203
Email: faiza.azhar@sse.habib.edu.pk
Office Hours: TBD

Course Description

This course will teach applied digital image processing to senior undergraduate students. The course will take a project based approach. Students will be able to apply and learn by doing things practically

in Matlab® and python/C++ whichever is available.

Course Aims

This course aims to introduce students to image processing. Over the duration of this course, students will learn about how images are stored and processed, what are the different domains of image processing, how images may be represented, how we may apply different types of transformations on an image etc. The knowledge of image processing will help students during their career as all real world applications store data mostly as images or videos. Equipped with this image processing knowledge, students should be able to identify easily the most appropriate filtering pipeline for their use case.

Course Learning Outcomes (CLOs)

The students who are able to complete this course will be able to:

- **identify** commonly used image processing techniques (CLO-1)
- **apply** image processing algorithms to diverse computational problems (CLO-2)
- **analyze** images in both spatial and frequency domain (CLO-3)
- **design** new image processing pipelines (CLO-4)
- **develop** applications using techniques learned in this course (CLO-5)

Mode of Instruction

This course will be delivered online using 50% synchronous and 50% asynchronous content. The instructors will host Zoom meetings at allotted times and in case of asynchronous sessions videos would be uploaded on LMS.

Engagement, Net-etiquettes & Participation Rules

a. Students are expected to maintain class discipline and punctuality.

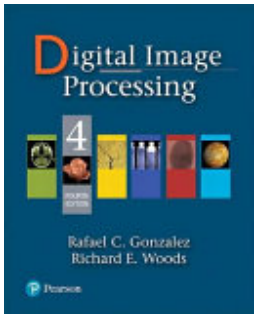
b. For good class participation they should actively ask questions and contribute to discussions with the instructors as well as with their colleagues.

c. In order to maintain a collegial atmosphere one should be respecting others opinions, and slang or use of violent language on the chat platforms should be avoided.

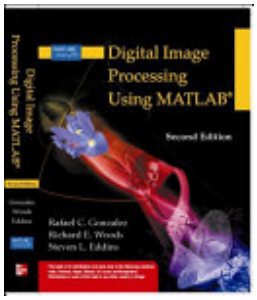
d. The instructor will specify the mic and video turning on policy during each class at the start.

e. For the labs, students should try to finish all lab activities during lab timings.

Required Texts and Materials

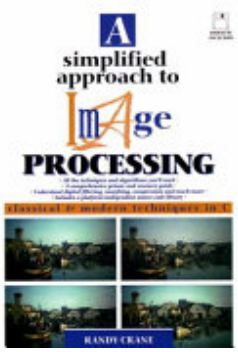


Digital Image Processing
ISBN: 9780133356724
Authors: Rafael C. Gonzalez, Richard Eugene Woods
Publication Date: 2018-01-01



Digital Image Processing Using MATLAB
ISBN: 9780070702622
Authors: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins
Publisher: Tata McGraw-Hill Education
Publication Date: 2010-01-01

Optional Materials



A Simplified Approach to Image Processing
ISBN: 9780132264167
Authors: Randy Crane
Publisher: Prentice Hall
Publication Date: 1997-01-01

Assessments

Students will be assessed based on assignments and quizzes only. Detailed breakage is as follows:

- 20% Quizzes (2% x 10) (Expect a short quiz in every week/class, Top 10 quizzes will be taken.)
- 40% Assignments (10% + 10% + 10% + 10%)
- 40% Project (in groups of 2 students per project)

Grading Scale

Letter Grade	GPA Points	Percentage
A+	4.00	[95-100]
A	4.00	[90-95)
A-	3.67	[85-90)
B+	3.33	[80-85)
B	3.00	[75-80)
B-	2.67	[70-75)
C+	2.33	[67-70)
C	2.00	[63-67)
C-	1.67	[60-63)
F	0.00	[0, 60]

Note: [a, b) is a range of numbers from a to b where a is included in the range and b is not.

Week-Wise Schedule (Tentative)

Fall 2022 Weekly Schedule*

Week	Description	Topics	Readings	Assessments and Due Date
Week - 1 August 22 – 26	Sessions & Add / Drop period	Introduction, Basics of Matlab, Setting up image processing in C/C++ and Python	Chapter 1	Quiz 1

Week	Description	Topics	Readings	Assessments and Due Date
Week - 2 August 29 - September 2	Sessions Last day to Drop Course(s): **August 31, 2022** Last day to Add Course(s): **September 2, 2022**	Relationships (pixels, adjacency, connectivity, regions, boundary)	Chapter 2	Quiz 2
Week - 3 September 5 – 9	Sessions	Distance metrics and domains of image processing	Chapter 3	Quiz 3/Project Proposal Presentations/Groups Finalization
Week - 4 September 12 – 16	Sessions	Point processing, Affine transforms, Linear and non-linear operations	Chapter 3	Quiz 4/Assignment 1 Release: Sept 13, Due: Sept 20
September 18, 2022	Arbaeen/Chehlum Imam Hussain†‡			
Week - 5 September 19 – 23	Sessions	Histogram processing and equalization	Chapter 3	Quiz 5
Week - 6 September 26 – 30	Sessions	Area filtering in the spatial domain	Chapter 3	Quiz 6
Week - 7 October 3 – 7	Sessions & Mid Term Examinations	Image processing in the frequency domain	Chapter 4	Quiz 7/Assignment 2 Release: Oct.3, Due: Oct 10
Week - 8 October 10 – 14	Sessions & Mid Term Examinations	Area filtering in the frequency domain	Chapter 4	Quiz 8
Week - 9 October 17 – 21	Sessions	Mid Presentations	Chapter 7	Quiz 9/Project Mid Presentations

Week	Description	Topics	Readings	Assessments and Due Date
Week - 10 October 24 – 28	Sessions	Color fundamentals and color spaces	Chapter 8	Quiz 10/Assignment 3 Release: Nov 1, Due: Nov 8
Week - 11 October 31 - November 4	Sessions Last Day to Withdraw from Course(s): **November 4, 2022**	Image compression (Huffman, LZW, jpeg)	Chapter 10	Quiz 11
Week - 12 November 7 – 11	Sessions	Image segmentation (water shed, active contours, graph cut)	Chapter 11	Quiz 12
Week - 13 November 14 – 18	Sessions	Image recognition (bar code, QRcode, finger print recognition)	Chapter 13	Quiz 13/Assignment 4 Release: Nov 21, Due: Nov 28
Week - 14 November 21 – 25	Sessions	Image morphological operations	Chapter 9	Quiz 14
Week - 15 November 28 - December 2	Sessions Last Day of Classes **December 2 2022**	Project Presentations		Project Final Presentation/Demos
December 5 - 6	Reading Days			
December 7-10 & 12 – 13, 2022	End Term Examinations Days§			

Notes:

* The University reserves the right to correct typographical errors or to adjust the Academic Calendar at any time it deems necessary.

† Subject to the sighting of the new moon.

‡ No Class(es).

Final Exam Policy

There will be no final exam.

Late Submission Policy

Failure to submit by the deadline would result in a 20% grade reduction and a further 10% of the grade reduction will be applied for every delay of 24 hours.

Academic Integrity

Each student in this course is expected to abide by the Habib University Student Honor Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work.

Scholastic dishonesty shall be considered a serious violation of these rules and regulations and is subject to strict disciplinary action as prescribed by Habib University regulations and policies. Scholastic dishonesty includes, but is not limited to, cheating on exams, plagiarism on assignments, and collusion.

a. Plagiarism: Plagiarism is the act of taking the work created by another person or entity and presenting it as one’s own for the purpose of personal gain or of obtaining academic credit. As per University policy, plagiarism includes the submission of or incorporation of the work of others without acknowledging its provenance or giving due credit according to established academic practices. This includes the submission of material that has been appropriated,// bought, received as a gift, downloaded, or obtained by any other means. Students must not, unless they have been granted permission from all faculty members concerned, submit the same assignment or project for academic credit for different courses.
b. Cheating: The term cheating shall refer to the use of or obtaining of unauthorized information in order to obtain personal benefit or academic credit.
c. Collusion: Collusion is the act of providing unauthorized assistance to one or more person or of not taking the appropriate precautions against doing so.

All violations of academic integrity will also be immediately reported to the Student Conduct Office.

You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having

possession of a copy of all or part of work done by someone else, in the form of an e-mail, an e-mail attachment file, a diskette, or a hard copy.

Should copying occur, the student who copied work from another student and the student who gave material to be copied will both be in violation of the Student Code of Conduct.

During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Penalty for violation of this Code can also be extended to include failure of the course and University disciplinary action.

Attendance Policy

Students are expected to watch all pre-recorded sessions and attend all synchronous sessions. Faculty members will measure attendance in dynamic ways including in class participation, feedback on recorded sessions, performance in assessments etc. Students failing to join any live session must inform their instructor within 24 hours along with the reason. If a student can't attend any or majority of the live sessions and the nature of the class requires in-class participation then the student can be dropped from the course. Please refer to the COVID-19 attendance policy for more details

Program Learning Outcomes (For Administrative Review)

Upon graduation, students will have the following abilities:

- PLO 1: Analysis: Analyse a given situation and reduce it to one or more problems that can be solved via computer intervention.
- PLO 2: Design: Design one or more computer-based solutions of a given problem and select the solution that is best under the circumstances.
- PLO 6: Self-learning: Research, learn, and apply requirements needed to implement a solution for a given high level problem description.
- PLO 8: Communication and Teamwork: Work effectively in inter-disciplinary teams.

Program Learning Outcomes (PLOs) mapped to Course Learning Outcomes (CLOs)	
	CLOs of the course are designed to cater following PLOs:

	PLO 1: Analysis **PLO 2:** Design **PLO 6:** Self-learning **PLO 8:** Communications and Teamwork

	Distribution of CLO weightages for each PLO				
	CLO 1	**CLO 2**	**CLO 3**	**CLO 4**	**CLO 5**
PLO 1	20%		80%		
PLO 2				60%	40%
PLO 6		40%		30%	30%
PLO 8	30%	30%		40%	

Mapping of Assessments to CLOs

Assignments	**CLO #01**	**CLO #02**	**CLO #03**	**CLO #04**	**CLO #05**
Assignment 1	X	X			
Assignment 2		X	X		
Assignment 3			X		
Assignment 4				X	X
Quiz 1-3	X	X			
Quiz 4-6		X	X		
Quiz 7-10	X		X		
Quiz 11-12			X	X	
Quiz 13-14				X	X
Project	X	X	X	X	X

Recording Policy

Only asynchronous and synchronous online sessions will be recorded and uploaded on our Video Management System (Panopto). Link to the folder of recordings will be available to all students. Hyflex classes might be recorded if faculty deems it appropriate.

Accommodations for Students with Disabilities

In compliance with the Habib University policy and equal access laws, I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first two weeks of the semester, except for unusual circumstances, so arrangements can be made. Students are encouraged to register with the Office of Academic Performance to verify their eligibility for appropriate accommodations.

Inclusivity Statement

We understand that our members represent a rich variety of backgrounds and perspectives. Habib University is committed to providing an atmosphere for learning that respects diversity. While working together to build this community we ask all members to:

- share their unique experiences, values and beliefs
- be open to the views of others
- honor the uniqueness of their colleagues
- appreciate the opportunity that we have to learn from each other in this community
- value each other's opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- use this opportunity together to discuss ways in which we can create an inclusive environment in this course and across the Habib community

Office Hours Policy

Every student enrolled in this course must meet individually with the course instructor during course office hours at least once during the semester. The first meeting should happen within the first five weeks of the semester but must occur before midterms. Any student who does not meet with the instructor may face a grade reduction or other penalties at the discretion of the instructor and will have an academic hold placed by the Registrar's Office.