

CSCSE 4240/5225 Digital Image Processing

Instructor: Bill Buckles
Office: DP F275 (CSE Dept.)
Office hours: Thur: 3:00-5:00pm
Phone: 940-565-4869

Semester: Spring 2022
Time: 1:00pm-2:20pm TTh
Place: NTDP B192
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Course Description

Introduction to algorithms, mathematical tools, and various digital image applications. Gray level and multispectral image manipulation will be discussed. Students will work in teams to solve a significant image processing problem

Learning Outcomes

By the end of the course you will

- Be familiar with 2-D/3-D signals, sampling and filtering
- Be familiar with sensor modality and digital encoding
- Be able to filter and enhance images in the spatial domain and frequency domain
- Be able to perform image restoration
- Be able to perform region and edge segmentation
- Be able to design algorithms for object recognition

Course Requirements

Attendance: Attendance is mandatory. Lectures, videos, and class discussions will contain vital information needed to do well on exams.

Textbook: *Digital Image Processing*, 4th Ed., Rafael Gonzalez and Richard Woods, Pearson Pub., 2018, ISBN-13:9780133356724

Grading:

- **35% Midterm (to be done individually), 35% Final (cumulative, to be done individually);**
- **15% Group Exercises;**
- **5% Quizzes (to be done individually). Quizzes will be graded on the basis of submitted or not submitted. Missed quizzes cannot be made up but one missing quiz will be forgiven.**

(raw final grades will be curved)

Prerequisites: Probability theory, Calculus, Data structures, Proficiency with C/C++, Java, Python, or Matlab.

Policy for working in groups

When working in groups, you can distribute the work among group members. However, if your name is on the submission you are responsible for the submission. This means

- (i) You should be able to explain the algorithm/code/logic of the solution for all

parts of the project even if you were not directly involved in implementing it

- (ii) If any group member cheats, the entire group will be penalized

Group membership will be determined for you using the random membership function built into CANVAS.

Late Assignments

No points will be deducted for the first day (weekends included) of a late submission of an assignment. 10 points will be deducted after two days. The assignment will not be accepted after two days.

The assignment having the lowest grade will be dropped from the computation of the final grade.

Disabilities Accommodation:

The University of North Texas complies with Section 504 of the 1973 Rehabilitation Act and with the Americans with Disabilities Act of 1990. The University of North Texas provides academic adjustments and auxiliary aids to individuals with disabilities, as defined under the law. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring accommodation, please see the instructor and/or contact the Office of Disability Accommodation at 940-565-4323 during the first week of class.

COVID Protocols

COVID STATUS	TARGETED POPULATION	ISOLATION/QUARANTINE PERIOD
Confirmed positive COVID-19 test result	Everyone, regardless of vaccination status	<ul style="list-style-type: none">• Isolate for 5 days. If you have no symptoms or symptoms are resolving after 5 days, end isolation.• Recommended to wear a mask around others for 5 more days.
Exposure to someone with COVID-19 (Exposure defined as < 6 feet for > 15 minutes over a 24-hour period)	Everyone, regardless of vaccination status	<ul style="list-style-type: none">• Recommended to wear a mask around others for 10 days• Test on day 5, if possible• If symptoms develop at any point, isolate and get a test

Additionally, in event of a positive COVID-19 test, inform the instructor of your status and of the schedule for isolation. This is to assure that your absence from class will not affect your grade. Send your instructor the certification of your COVID test status. One can obtain a certification from the UNT **Student Health and Wellness Center** if the testing was done there.

In event of exposure, get in touch with the instructor and discuss a plan for testing, isolation, or both.

For further information, check the UNT COVID web site: <https://healthalerts.unt.edu/>.

NAME	OFFICE HOURS	EMAIL	ZOOM ADDRESS
Chatritha Dondapati		ChakrithaReddyDondapati@my.unt.edu	
B. Buckles	Thursday 3:00-5:00pm	bill.buckles@unt.edu	https://unt.zoom.us/j/3097198944

Meeting	Topic
1	T1. Introduction (Chapters 1 and 2)
	a. The light spectrum
2	b. Image representation – sampling and quantization
	c. 3-D images
	d. Image algebra
3	T2. Spatial filtering (Chapter 3)
	a. Intensity transformations
4	b. Histogram equalization
	c. Spatial convolution
5	d. Smoothing and sharpening
	e. Hough transforms (Chapter 10)
6	T3. Filtering in the frequency domain (Chapter 4)
	a. <i>Linear systems (not in text)</i>
	b. Fourier transform
	c. Sampling and aliasing
7	d. Special filters (ideal highpass/lowpass, Gaussian highpass/lowpass, Laplacian, unsharp masking)
8	T4. Wavelets (Chapter 7)
	a. Discrete wavelet transforms and subbands
	b. The Haar transform
	c. Multiresolution analysis
9	MIDTERM EXAM TENTATIVELY SCHEDULED
10	T5. Image restoration (Chapter 5)
	a. Types of noise
	b. Special filters (median, bandreject, bandpass)
11	c. Wiener filters
	d. <i>Image quality assessment (not in text)</i>

12	T6. Color (Chapter 6)
	a. Representation and color models
	b. Histograms
13	c. Smoothing and sharpening
	d. Segmentation and edge detection
14	T7. Morphological operations (Chapter 9)
	a. Erosion, dilation, opening, closing
	b. Hole filling and extracting connecting components
15	T8. Image segmentation (Chapter 10)
	a. Thresholding
16	b. Taxonomies (region growing/splitting, supervised/unsupervised)
	c. Watersheds
17	T9. Object recognition (Chapter 12)
	a. Fourier descriptors
18	b. Texture
19	PROJECT REPORTS
20	PROJECT REPORTS
21	REVIEW