GEORGIA INSTITUTE OF TECHNOLOGY
SCHOOL OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 6258/4803: Digital Image Processing (3-0-3)
Syllabus

Course Instructor: Prof. Ghassan AlRegib
alregib@gatech.edu
www.ghassanalregib.info

Course Days/Times: TBD

Office Hours: TBD

GTAs: TBD

Textbook: **No** textbook is required; the following books are excellent references for this class:

1. R.C. Gonzalez and R.E. Woods, *Digital Image Processing*, 3rd edition, Prentice-Hall, 2008 (*officially the textbook of the course*)
2. M. Petrou and C. Petrou, *Image Processing: The Fundamentals*, 2nd Edition, Wiley, 2010 (helpful reference in the first half of the semester)
3. J. W. Woods, *Multidimensional Signal, Image, and Video Processing and Coding*, 2nd Edition, Academic Press, 2012
4. M.J.T. Smith, A. Docef, *A Study Guide for Digital Image Processing*, Scientific Pub., 1999

Prerequisite: ECE 2026 [min C] (or equivalent)
Prerequisites with concurrency:
ECE 3077 [min C] or ISYE/MATH/CEE 3770 [min C] or MATH 3670 [min C]

Course Objective: An introduction to the fundamentals and the theory of multidimensional signal processing and digital image processing, including key applications in multimedia products and services including machine learning

Academic Honesty: All violations of the Georgia Tech Honor Code will be handled by referring the case directly to the Dean of Students for investigation and penalties.

Grading:
For Undergraduate students:

Homework	25%	Exams	65%
Project	10%		

For Graduate students:

Homework	25%	Exams	50%
Project	25%		

For graduate students enrolled in ECE6258, the final project will require additional components to be outlined in class in the first two weeks. The project for graduate students will be at the level of producing a short conference paper (4~6 pages, double-column IEEE style). The project for the undergraduate

students will be of the format of reproducing results in a short publication to be determined in the first a few weeks in the semester. Note that for all students, the final project presentations may be held partially during the final exam time slot for the course; accordingly, you must plan on being able to attend the presentations at that time, as this will be a requirement for the course.

Programming Language: We strongly recommend to utilize Python throughout the course. We have prepared a library called Dippykit to help you perform the tasks within the course. Visit https://dippykit.github.io/dippykit/ to get started.

Canvas: Go to https://canvas.gatech.edu/ and if you do not see the class page, make sure you are registered for the course.

Piazza: Students are expected to utilize PIAZZA platform to post questions and engage into online discussions. Make sure you enroll into the course site on Piazza. If you have any problems or feedback for the developers, email team@piazza.com. Find our class page at: (TBD)

Assignments Submission: All homework assignments need to be submitted on Canvas. Read the instructions of each assignment carefully.

Attendance: Your attendance and participation are strongly encouraged. There has been a strong correlation between attending lectures and the earned letter grade in this class. Check the Institute Absence Policy at: http://www.catalog.gatech.edu/rules/4/.

Academic Honesty: All violations of the Georgia Tech Honor Code will be handled by referring the case directly to the Dean of Students for investigation and penalties. The complete honor code can be found at this link: http://www.policylibrary.gatech.edu/student-affairs/academic-honor-code

Available Resources:

- The Center for Academic Success has programs to help students improve their study habits and time management: http://www.successprograms.gatech.edu/.
- The Dean of Students Office helps students who have personal or medical issues that impact their academic performance: http://www.deanofstudents.gatech.edu/

Office of Disability Services: If you are a student registered with the Office of Disability Services (ODS), please make sure the appropriate forms and paperwork are completed with the instructor within the first week of classes. The instructor will abide by all accommodations required by ODS. The schedule for exams is posted in the syllabus and any potential modifications or changes will be made with at least one week's notice. It is the responsibility of the student to properly arrange test accommodations for each exam with ODS in sufficient time to guarantee space for exam administration. ALL exam accommodations must be handled through ODS. If the student does not register accommodations with ODS for the taking of an exam, then they will have to take the exam at the normally scheduled times without any additional accommodation unless the instructor is given specific directive from ODS on the student's behalf due to a mitigating circumstance. (https://disabilityservices.gatech.edu/)

Announcements: Official announcements will be posted on Canvas or Piazza or announced during lectures.

Topical Outline:

Week	Lecture Topic
1	Introduction, Syllabus, Acquisition, Color
	Image Representation: Multidimensional Signal Processing (MDSP)
2	Image Representation: Multidimensional Signal Processing (MDSP)
	Image Representation: Sampling
3	Image Representation: Interpolation
	Image Representation: Image Quality Assessment (IQA)
4	Image Representation: Image Quality Assessment (IQA)
	Image Transform: DFT and DTFT
5	Image Transform: DCT and DST
	Image Transform: DWT
6	Image Transform: KLT
	Exam #1 (Tentative)
7	Image Learning: ANNs
	Image Learning: CNNs
8	Image Coding: Entropy
	Image Coding: JPEG and JPEG2000
9	Fall mid-term Recess
	Image Transform: Autoencoder (AE)
10	Image Coding: Motion Estimation and Optical Flow
	Image Coding: Video Coding
11	Exam #2 (Tentative)
	Image Enhancement: Denoising
12	Image Enhancement: Sharpening
	Image Enhancement: Denoising
13	Image Analysis: Saliency
	Image Analysis: Detection
14	Exam #3 (Tentative)
	Image Analysis: Clustering
	Image Analysis: Classification
15	Image Analysis: Robustness in ML
	Thanksgiving Holiday
16	Image Analysis: Explainability in ML Applications
	Image Analysis: Segmentation and Computation Imaging