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:  
   (officially the textbook of the course)  
   reference in the first half of the semester)  
   Academic Press, 2012  

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%  
   Project 10%  
   Exams 65%  

For Graduate students:  
   Homework 25%  
   Project 25%  
   Exams 50%  

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/](https://dippykit.github.io/dippykit/) to get started.

**Canvas:** Go to [https://canvas.gatech.edu/](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](mailto: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/](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](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/](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/](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/](https://disabilityservices.gatech.edu/))

**Announcements:** Official announcements will be posted on Canvas or Piazza or announced during lectures.
## Topical Outline:

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topic</th>
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| 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) |
| 12   | Image Enhancement: Denoising  
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 |
| 16   | Thanksgiving Holiday  
Image Analysis: Explainability in ML Applications  
Image Analysis: Segmentation and Computation Imaging |

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