

## **Digital Image Processing and Computer Vision**

EEE 6512 Sections 012A, 013D, 19DF, 2G34

**Class Periods:** Tues., Period 7, 1:55 PM – 2:45 PM,  
Thurs., Periods 7 – 8, 1:55 PM – 3:50 PM

**Location:** NEB 201

**Academic Term:** Fall 2019

### ***Instructor:***

- Name: Dr. Damon L. Woodard
- Email Address: [dwoodard@ece.ufl.edu](mailto:dwoodard@ece.ufl.edu)
- Office Phone Number: 352-273-2130
- Office Hours: Tues. 8:00 AM – 10:00 AM, Thurs., 8:00 AM – 9:00 AM or by appointment, 226E Materials Engineering Bldg.

### ***Teaching Assistants:***

- Name: Ronald Wilson
- Email Address: [ronaldwilson@ufl.edu](mailto:ronaldwilson@ufl.edu)
- Office Hours: TBA
  
- Name: Hangwei (Alice) Lu
- Email Address: [qslvhw@ufl.edu](mailto:qslvhw@ufl.edu)
- Office Hours: TBA

### ***Course Description***

Pictorial data representation; feature encoding; spatial filtering; image enhancement; image segmentation; cluster seeking; two-dimensional z-transforms; scene analysis; picture description language; object recognition; pictorial database; interactive graphics; picture understanding machine.

**Credits:** 3

### ***Course Pre-Requisites / Co-Requisites***

- EEE-5502 Foundations of Signal Processing
- Undergraduate-level probability and statistics course
- Undergraduate-level linear algebra course
- Exposure to MATLAB programming

### ***Course Objectives***

This course introduces students to the fundamental principles and methods used for image processing and computer vision. The goal of this course is to understand how to efficiently represent, process, and analyze image signals. The objective of the course is to provide students with the scientific foundations needed to implement and apply techniques used to address image analysis related problems. Topics to be covered include: image acquisition and display using digital devices, properties of human visual perception, sampling and quantization, image enhancement, two-dimensional Fourier transforms, linear and nonlinear filtering, morphological operations, noise removal, image deblurring, edge detection, geometric transformations, segmentation, and object recognition (classification). The course objective

will be met by the completion of multiple homework assignments which require the implementation and application of image processing / computer vision methods discussed during lecture. Also, the students' understanding of the main concepts will be assessed using multiple exams.

### ***Materials and Supply Fees***

None

### ***Required Textbooks and Software***

- Title: Digital Image Processing
- Author: Rafael C. Gonzales and Richard E. Woods
- Publication date, edition, and publisher: 2018, Fourth Edition, Person
- ISBN number: 9780133356724

Software: Mathematical solver software such as MATLAB (available at UF ECE terminal server available by remote login)

### ***Recommended Materials***

- Title: Computer Vision: Algorithms and Applications
- Author: Richard Szeliski
- Publication date, edition, and publisher: 2010, 2011 Edition, Springer
- ISBN number: 978-1848829343

### ***Course Schedule (Tentative)***

Week 1: Course Overview, Introduction  
Week 2: Fundamentals of Imaging / **Homework #1 Due**  
Week 3: Image Transformations and Spatial Filtering Pt. 1  
Week 4: Spatial Filtering Pt. 2 / **Homework #2 Due**  
Week 5: Frequency Domain Filtering Pt. 1 / **Exam #1**  
Week 6: Frequency Domain Processing Pt. 2 / **Homework #3 Due**  
Week 7: Color Image Processing  
Week 8: Morphological Image Processing / **Homework # 4 Due**  
Week 9: Image Segmentation Pt. 1  
Week 10: Image Segmentation Pt. 2 / **Exam #2**  
Week 11: Feature Extraction Pt. 1 / **Homework #5 Due**  
Week 12: Feature Extraction Pt. 2  
Week 13: Model Fitting Pt. 1 / **Homework #6 Due**  
Week 14: Model Fitting Pt. 2 / Classification Pt. 1  
Week 15: Classification Pt. 1 / **Exam #3**  
Week 16: Classification Pt. 2

### ***Attendance Policy, Class Expectations, and Make-Up Policy***

Although attendance will not be recorded, it is expected that students attend all lectures. Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

Students are expected to take measures to minimize distractions for everyone (i.e. no newspapers, cell phone, PDA, laptops, etc. unless instructed to use them for class.

Makeup exams are contingent on appropriate justifications and legal documents (UF Dean of Students, certified physician, military active duty, judge for jury duty, etc.) Late assignments **will not** be accepted.

### ***Evaluation of Grades***

<b>Assignment</b>	<b>Percentage of Final Grade</b>
Homework Sets (6)	50%
Exams (3)	50%
<b>TOTAL</b>	<b>100%</b>

### ***Grading Policy***

<b>Percent</b>	<b>Grade</b>	<b>Grade Points</b>
94 - 100	A	4.00
90 - 93	A-	3.67
88 - 89	B+	3.33
82 - 87	B	3.00
80 - 81	B-	2.67
78 - 79	C+	2.33
72 - 77	C	2.00
70 - 71	C-	1.67
62 - 69	D	1.00
0 - 61	E	0.00

### ***Students Requiring Accommodations***

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

### ***University Honesty Policy***

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any

condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

### ***Commitment to a Safe and Inclusive Learning Environment***

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, [rbielling@eng.ufl.edu](mailto:rbielling@eng.ufl.edu)
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, [taylor@eng.ufl.edu](mailto:taylor@eng.ufl.edu)
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, [nishida@eng.ufl.edu](mailto:nishida@eng.ufl.edu)

### ***Software Use***

All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

### ***Student Privacy***

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

### ***Campus Resources:***

#### ***Health and Wellness***

##### **U Matter, We Care:**

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

**Counseling and Wellness Center:** <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

##### **Sexual Discrimination, Harassment, Assault, or Violence**

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, [title-ix@ufl.edu](mailto:title-ix@ufl.edu)

##### **Sexual Assault Recovery Services (SARS)**

Student Health Care Center, 392-1161.

**University Police Department** at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

**E-learning technical support**, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.  
<https://lss.at.ufl.edu/help.shtml>.

**Career Resource Center**, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

**Library Support**, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

**Teaching Center**, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.  
<https://teachingcenter.ufl.edu/>.

**Writing Studio, 302 Tigert Hall**, 846-1138. Help brainstorming, formatting, and writing papers.  
<https://writing.ufl.edu/writing-studio/>.

**Student Complaints Campus**: [https://www.dso.ufl.edu/documents/UF\\_Complaints\\_policy.pdf](https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf).

**On-Line Students Complaints**: <http://www.distance.ufl.edu/student-complaint-process>.