

# Image Processing and Computer Vision

EEL 4930 (30119)

**Class Periods:** MWF Period 5 (11:45 AM – 12:35 PM)

**Location:** NEB 201

**Academic Term:** Spring 2023

## **Instructor:**

Name: Damon L. Woodard, Ph.D.

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Office Phone Number: 352-273-2130

Office Hours: Mondays and Wednesdays, 9:00 AM – 10:00 AM, or By Appointment

Zoom Link: <https://ufl.zoom.us/j/9966679004>

## **Teaching Assistant/Peer Mentor/Supervised Teaching Student:**

Please contact through the Canvas website

- To Be Determined

## **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**

- EEL-3135 Introduction to Signals and Systems
- 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 that 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

## **Relation to Program Outcomes (ABET):**

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare,	

as well as global, cultural, social, environmental, and economic factors	
3. An ability to communicate effectively with a range of audiences	
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

### **Required Textbooks and Software**

- Title: Image Processing and Analysis
  - Author: Stan Birchfield
  - Publication date, edition, and publisher: 2017, First Edition, CL Engineering
  - ISBN number: 978-1285179520
- Software: Mathematical solver software (MATLAB)

### **Recommended Materials**

- None

### **Course Schedule**

<b>Wk</b>	<b>Topic</b>	<b>Lecturer</b>	<b>Chapters</b>	<b>Exam</b>
1	Course Overview, Introduction, Fundamentals of Imaging	Woodard	1,2	
2	Fundamentals of Imaging Cont., Image Transformations / <b>Homework #1 Due</b>	Woodard	3	
3	Image Transformations Cont.	Woodard	3	
4	Image Transformations Cont. / <b>Homework #2 Due</b>	Woodard	3	
5	Binary Image Processing	Woodard	4	Exam #1
6	Spatial Domain Filtering / <b>Homework #3 Due</b>	Woodard	5	
7	Frequency Domain Processing	Woodard	6	
8	Edges and Features / <b>Homework # 4 Due</b>	Woodard	7	
9	Edges and Features Cont. & Color	Woodard	7,9	Exam #2
10	No Lecture, Spring Break	Woodard		
11	Color Cont. / <b>Homework #5 Due</b>	Woodard	9	
12	Segmentation	Woodard	10	
13	Segmentation Cont. & Model Fitting / <b>Homework #6 Due</b>	Woodard	10,11	
14	Model Fitting Cont. & Classification	Woodard	11	Exam #3
15	Classification Cont.	Woodard	12	
16	Course Review, Finals Week	Woodard		Final Exam

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

**Special Topics: Image Processing and Computer Vision, EEL-4930**  
**Dr. Damon L. Woodard, Spring 2024**

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

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

<b>Assignment</b>	<b>Percentage of Final Grade</b>
Homework Sets (6)	50%
Exams (3)	30%
Final Exam	20%
<b>TOTAL</b>	<b>100%</b>

Students will be allowed to drop the lowest homework assignment grade for the final course grade calculation. Homework assignments may be turned in up to three days after the due date but will receive a 10% per day point deduction.

This course is co-listed with the graduate course EEE-6512 Image Processing and Computer Vision, for which homework assignments will be graded differently. Each homework assignment will consist of problem sets and a software programming component. In the case of problem sets and exams, assessment questions of varying difficulty will be included and weighted differently compared to the graduate course. In addition, the programming portion of the homework assignments will include fewer requirements as compared to the graduate course.

### ***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

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

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

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

### ***Course Evaluation***

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.ua.ufl.edu/public-results/>.

### ***In-Class Recording***

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

### ***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://sccr.dso.ufl.edu/process/student-conduct-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 varied perspectives and lived experiences within our community and is committed to supporting the University’s core values, including the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

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
- HWC OE Human Resources, 352-392-0904, [student-support-hr@eng.ufl.edu](mailto:student-support-hr@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 students 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:** <https://counseling.ufl.edu>, 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](mailto:Learning-support@ufl.edu).  
<https://lss.at.ufl.edu/help.shtml>.

**Career Connections Center**, Reitz Union, 392-1601. Career assistance and counseling; <https://career.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://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

**On-Line Students Complaints:** <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.