

Fall 2020

Imaging System Analysis

ENU 5658; Section 1D03; 3 Credits

CLASS MEETING INFO

2:50p-4:05p; T,Th
?? CG-49, Communicore ??

INSTRUCTOR

David Gilland; gilland@ufl.edu; 265-0293
Office Hours: email for appointment

TEACHING ASSISTANTS

N/A

DESCRIPTION

The application of linear systems theory for the analysis of medical imaging systems with an emphasis on radiological imaging. Topics covered include the following: convolution, Fourier Transform, linear filtering, sampling theory, image reconstruction from projections and methods for image quality evaluation. 3 credit hours

PRE-REQUISITES/CO-REQUISITES

Calculus 1-3 (MAC2311, MAC 2313 and MAC 2313) or equivalent

OBJECTIVES

- Develop in depth understanding of fundamental mathematics used to analyze radiological imaging systems.
- Develop skills to apply theoretical analysis in practice using software tools.
- Understand fundamental issues in radiological image quality evaluation.
- Develop skills to evaluate and present results of original research papers.

MATERIALS AND SUPPLY FEES – N/A

REQUIRED TEXTBOOKS & SOFTWARE

- A. Title: *The Essential Physics of Medical Imaging*
Author: J.T. Bushberg
Publication date and edition: 2012, 3rd edition
ISBN number: 978-1-4511-1810-0
- B. Matlab (available at apps.ufl.edu)

Additional reading will be assigned from:

- Barrett and Swindell, *Radiological Imaging*
- Castleman, *Digital Image Processing*
- Macovski, *Medical Imaging Systems*
- research articles distributed in class.

RECOMMENDED MATERIALS -- N/A

COURSE SCHEDULE

Week	Topic	Reading
1	digital image display, file formats	Bushberg Ch.1, 5.1-5.5
2	Linear Systems Theory in Medical Imaging	B&S: 2.1-2.2, Appendix. A.1
3	Convolution, point spread function	B&S: 2.3, App. B.1-B.4, Bushberg: 4.2
4	Sinusoid input, MTF, Convolution Theorem	
5	Linear filters, Fourier Transform	B&S 2.4
6	Fourier Transform	
7	Sampling Theory	B&S 2.5, Castleman 12.1-12.2, Bushberg 4.5
8	Exam 1	
9	General radiological model	B&S: 4.1, 4.3
10	Noise in radiological images	Bushberg: 4.5, 4.6
11	Radon Transform, Central Slice Theorem	Bushberg: 10.4, Macovski: pp. 117-129
12	Filtered Backprojection, Iterative Reconstruct.	Brooks & DiChiro, Macovski: pp. 114-117 Bruyant
13	Image quality evaluation, ROC	Metz
14	Student paper presentations	
15	Exam 2	

ATTENDANCE POLICY; CLASS EXPECTATIONS; MAKE-UP POLICY

- On time class attendance and participation in class discussions are expected.
- Material will be presented during class that will not be available electronically but will be necessary for homework assignments and exams. Therefore, note taking is highly encouraged. If a class is missed, arrangements should be made to get the notes from a classmate.
- Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>
- Excused absences must be consistent with university policies in the Graduate Catalog and require appropriate documentation:
<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>

EVALUATION OF GRADES

60% Homework/presentations

20% Quiz 1

20% Quiz 2

GRADING POLICY

Percent	Grade
93-100	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-66	D
60-62	D-
59 & below	E

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

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.

EVALUATIONS

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.

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:

<http://registrar.ufl.edu/catalog0910/policies/regulationferpa.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 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

352-392-1575; <http://www.counseling.ufl.edu/cwc>

Sexual Assault Recovery Services (SARS)

352-392-1161; Student Health Care Center

University Police Department

352-392-1111 (or 911 for emergencies); <http://www.police.ufl.edu/>

Academic Resources

E-learning Technical Support

352-392-4357 (select option 2); learning-support@ufl.edu; <https://lss.at.ufl.edu/help.shtml>

Career Resource Center

Career assistance and counseling.

352-392-1601; Reitz Union; <https://www.crc.ufl.edu/>

Library Support

Various ways to receive assistance with respect to using the libraries or finding resources.

<http://cms.uflib.ufl.edu/ask>

Teaching Center

General study skills and tutoring.

352-392-2010 or 352-392-6420; Broward Hall; <https://teachingcenter.ufl.edu/>

Writing Studio

Help brainstorming, formatting, and writing papers.

352-846-1138; 302 Tigert Hall; <https://writing.ufl.edu/writing-studio/>

Student Complaints Campus

https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf

On-Line Students Complaints

<http://www.distance.ufl.edu/student-complaint-process>