College of Medicine
Medical Sciences
Medical Physics Graduate Program

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MedPhysics.med.ufl.edu

Fall 2023

Research Methods in Medical Physics

GMS 6086; 2 credits

CLASS MEETING INFO
Tuesdays and Thursdays 10:40 AM – 11:30 AM
Rom C2-33
Course materials on Canvas

INSTRUCTORS
Stephanie Leon, PhD; leons@radiology.ufl.edu
BC Schwarz, PhD; schwbc@radiology.ufl.edu
Office Hours: Arrange via email

TEACHING ASSISTANTS
TJ Moretti, MS; tmor0009@radiology.ufl.edu

DESCRIPTION
Prepares students for their MS and PhD research in medical physics by teaching concepts essential to understanding the existing body of literature and creating and communicating new research. This course is divided into three modules, each with a specific focus. Module one introduces relevant concepts in statistics and experimental design. Module two exposes students to two widely-used techniques in medical physics research: artificial intelligence and Monte Carlo simulation. Module three teaches students about research ethics, how to appropriately conduct a literature review, and how to communicate research results professionally.

PRE-REQUISITES/CO-REQUISITES
Graduate student status in the medical physics program.

OBJECTIVES
1. Students will learn essential concepts of statistics and experimental design, with special relevance to graduate research in medical physics.
2. Students will gain competence using the statistical software JMP Pro, using examples relevant to medical physics.
3. Students will learn research and communication skills, including principles of literature searches and best practices for presenting data in posters, abstracts, manuscripts, and oral presentation.
4. Students will undergo IRB and HIPAA training.
5. Students will develop an understanding of common techniques used in medical physics research, including Monte Carlo simulation and artificial intelligence, for the purpose of understanding research conducted using these techniques.

MATERIALS AND SUPPLY FEES
None

REQUIRED TEXTBOOKS & SOFTWARE
"Intuitive Biostatistics" by Harvey Motulsky, 4th ed. Oxford University Press. 2018.
Microsoft Excel
SAS JMP (https://software.ufl.edu/software-listings/sas-jmp.html)

RECOMMENDED MATERIALS
None

COURSE SCHEDULE

Date	Lecture	Topic	Instructor
24-Aug	1	Asking a good research question; the scientific method; *HW 1*	Leon
29-Aug	2	Why do we need statistics? Intuition and probability	Leon
31-Aug	3	Kinds of data, types of variables, descriptive statistics	Leon
5-Sep	4	Gaussian,Poisson, lognormal distributions	Leon
7-Sep	5	Confidence intervals and extrapolating error; *HW 2*	Leon
12-Sep	6	P values and their interpretation	Leon
14-Sep	7	Type I/Type II errors and their uses: Statistical power, sample size, ROC curves	Leon
19-Sep	8	Statistical tests; ***Take-home test 1***	Leon
21-Sep	9	Statistical tests	Leon
26-Sep	10	Correlation and linear regression	Leon
28-Sep	11	Nonlinear and multiple Regression; *HW 3*	Leon
3-Oct	11	Multiple comparisons; ANOVA	Leon
5-Oct	12	How things go wrong	Leon
10-Oct	14	Fundamentals of machine learning; ***Take-home test 2***	Leon
12-Oct	15	Types of AI	Leon
17-Oct	16	Neural networks and CNNs	Leon
19-Oct	17	Specialized networks, issues of bias and ethics	Leon
24-Oct	18	Applications of AI in medical physics	Moretti
26-Oct	19	Mathematical basis of Monte Carlo Methods; ***Take-home test 3***	Schwarz
31-Oct	20	Defining the problem (source, geometry, tallies)	Schwarz
2-Nov	21	Defining the problem 2 (source, geometry, tallies) ; *HW 4*	Schwarz
7-Nov	22	Understanding results, variance reduction	Schwarz
9-Nov	23	Applications of Monte Carlo methods in medical physics	Schwarz
14-Nov	24	Publication and research ethics; *HW 5*	Schwarz
16-Nov	25	Principles of literature reviews	Leon/Pomputius
21-Nov	26	How to read a paper (readings only – no lecture)	Leon
28-Nov	27	Literature review demo	Leon/Pomputius
30-Nov	28	Communicating results: scientific writing; *HW 6*	Leon
5-Dec	29	Graphical displays	Leon
December 12		***Final projects due***	

ATTENDANCE POLICY; CLASS EXPECTATIONS; MAKE-UP POLICY

Attendance is required during this course. Any class periods that may be missed should be brought to the attention of the instructors as far in advance as possible.

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

A list of assignments in each category is found below the table. Each assignment is weighted equally within its category.

Assignment Category	Percentage of Final Grade
Exams	30%
Homework	50%
Final Project	20%
	Total: 100%

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