

Biomedical Data Science

BME6938 Section 3A14

Class Periods: T | Period 7 (1:55 PM - 3:50 PM) -- R | Period 7 - 8 (1:55 PM - 2:45 PM)

Location: WEIM 1084 (Tuesday), WEIM 1084 (Thursday)

Academic Term: Fall 2021

Instructor:

Parisa Rashidi

Email Address: parisa.rashidi@ufl.edu (Please contact through the Canvas)

Office Phone Number: 352-392-9469

Office Hours: by appointment, virtual

Supervised Teaching Student:

David Johnson, david.johnson2@ufl.edu (Please contact through Canvas)

Office location: TBA

Office hours: TBA

Course Description

This course covers the biomedical applications of data science techniques and discusses the challenges in applying data science techniques in this domain. It also covers the programming frameworks and tools used for building machine learning and deep learning models for solving biomedical problems.

Course Pre-Requisites / Co-Requisites

Prereq: BME 3053C, COP2271, STA2023 or STA3032

Coreq: - N/A

Course Objectives

This course covers the biomedical applications of data science techniques, biomedical data science libraries, and challenges in using data science techniques in the biomedical domain.

1. Understand data science techniques in the biomedical domain,
2. Understand the limitations of each technique with respect to biomedical data,
3. Learn to use biomedical data science programming libraries.
4. Learn to critically analyze related recent literature.

Materials and Supply Fees

N/A

Professional Component (ABET):

N/A

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.	Medium

2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.	High
4. An ability to communicate effectively with a range of audiences	Medium
5. 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.	Medium
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.	
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty	

Required Textbooks and Software

- Course slides are developed and provided by the instructor. The students are responsible for taking additional notes.
- If you face any difficulties in using UF-provided tools such as Zoom or Canvas, visit the [UF helpdesk website](#) or call 352-392-4357.

Recommended Materials

- Course Number: BME 4760 - Biomedical Data Sci
- Title: Deep Learning for the Life Sciences
- Author(s): Vijay Pande, Patrick Walters, Peter Eastman, Bharath Ramsundar
- Copyright Date: April 2019
- Publisher: O'Reilly Media, Inc.
- Edition (if applicable): first
- ISBN: 9781492039822
- Optional

Course Schedule

Note. The course schedule might be subject to change.

Week	Subject	Biomedical Application	Assignment
1	Introduction		
2	Basic Python Programming	Electronic Health Record (EHR)	Q1

3	Advanced Python Programming	Clinical Data Processing	Project Proposal
4	Conventional Machine Learning I	Biophysical Modeling	Q2
5	Conventional Machine Learning II	Clinical Prediction	HW1
6	Neural Networks I		
7	Neural Networks II		HW2
8	Convolutional Neural Networks I	Biomedical Imaging	Q3
9	Convolutional Neural Networks II	Biomedical Imaging	HW3
10	Recurrent Neural Networks I	Physiological Signals	Q4
11	Recurrent Neural Networks II	Clinical Notes	HW4
12	Generative Models	Generating Drug Molecules	
13	Advanced Methods	Omics	Q5
14	Ethical AI	Adversarial Medical Attacks, Guidelines, Fair decision making, Bias	
15	Final Project Demo/Presentation		Final Demo/Presentation

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is required for live online sessions. Homework can only be made up for extraordinary circumstances with prior approval of the instructor. 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.

Evaluation of Grades

There will be four homework assignments which will cover machine learning programming in Python, corresponding to the topics covered in class (see course schedule). The final project will be an open-ended group project. In biomedical research, processing and analyzing clinical data, biomedical signals, and biomedical imaging data is an essential task in many applications. You can choose a project topic of your interest, spanning from EEG signal denoising, CT/MRI image restoration/registration, cell detection in microscopy images, outcome prediction using Electronic Health Records (EHR) data, frequency analysis of 1D/2D signals, etc. [A list of potential project ideas will be provided for your reference.] The students will be required to turn in their code, as well as a final report summary, and to present their project results at the end of the semester. Research articles will be assigned by the instructor and the student will need to either present their critique or present the paper. This syllabus is for a course with co-listed undergraduate and graduate sections. While both sections meet at the same time and are exposed to similar content, the expectations of students enrolled in each section (and their corresponding evaluation) differs to reflect the level of the course at which the student is enrolled, including different number of required paper presentation/discussion.

Assignment	Points	Percentage of Final Grade
Homework (4)	20 Each	20%
Final Project	100	30%
Exam (1)	100	35%
Paper Presentation (1) & Discussion (1)	100	15%

		100%
--	--	------

Grading Policy

Percent	Grade	Grade Points
94 – 100	A	4.00
90 – 93	A-	3.67
87 – 89	B+	3.33
83 – 86	B	3.00
80 – 82	B-	2.67
77 – 79	C+	2.33
73 – 76	C	2.00
70 – 72	C-	1.67
67 – 69	D+	1.33
63 – 66	D	1.00
60 – 62	D-	0.67
0 – 60	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 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 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.aa.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.aa.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://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
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, 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>

Online Privacy

Our class sessions may be audio visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Campus Resources:

Health and Wellness

You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

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: <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

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.

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