

GMS 6850: FOUNDATIONS OF BIOMEDICAL INFORMATICS (3 credit hours)

Fall 2023

LOCATION: HPNP 1102

CLASS HOURS: Thursdays 9:35am-12:35pm

INSTRUCTOR:

Jessica Ray, PhD

Clinical and Translational Research Building, Office 3228 (until building move)

Malachowsky Hall for Data Science and Information Technology, Office 7018 (after new building opens)

Phone: (321) 356-4346 (m)

Email: jessica.ray@ufl.edu

OFFICE HOURS: *By appointment*

* I am routinely on campus Wednesdays and Thursdays and will happily meet on a “drop-in” basis if I am not in meetings

COURSE COMMUNICATIONS: Students may email the instructor with questions but are encouraged to consider whether their questions are of general interest to the entire class. Dedicated class time will be devoted to discussing and answering general questions about either course content or course mechanics that are relevant to all students.

Course listserv for Fall 2023: Fall-2023-GMS6850-21943@lists.ufl.edu

You should be added to the listserv automatically through OneUF.

COURSE OVERVIEW:

Biomedical informatics is the science of information as studied in or applied to biomedicine. Its scope therefore is information in patient care, public health, biomedical research, and health sciences education. This course will cover foundational issues such as the nature of information, how biomedical information is unique, the purposes for which biomedical information is created and used, the methods of analysis and inference on biomedical information, and the ethical and privacy issues involved. A survey of various kinds of information systems and software in biomedicine and issues in their implementation and use will follow, including but not limited to electronic health records, software for analysis of genomic/genetic data, and public health surveillance systems.

The purpose of this course is to introduce students to the field of biomedical informatics and give them sufficient knowledge and skills in the discipline to (1) improve how they approach issues of information capture, management, and use in their careers, (2) understand and assess the biomedical informatics literature, (3) critically evaluate the reasonableness of proposed information system projects, and (4) pursue an academic degree in biomedical informatics if so desired.

COURSE OBJECTIVES:

1. Explain the fundamental nature of information and the implications for information capture and processing
2. Understand the unique issues that pertain to biomedical information vs. other types of information in health care, research, and education
3. Distinguish between ontology vs. epistemology, and data vs. what data are about
4. Read the biomedical informatics literature and understand key terms, descriptions, methods, results, and their implications
5. Engage organizational leadership, information technology professionals, subject matter experts, and other key stakeholders in decision making around and implementation of information systems in their future careers
6. Describe current trends and problems in the field of biomedical informatics
7. Articulate the human, organizational, social, and societal impacts of information and information systems and their significance To give students access to state-of-the-art tools, methods, and approaches for the protection of information security and data privacy.

TEXTBOOKS/READING MATERIALS:

- Shortliffe EH, Cimino JJ, eds. Biomedical Informatics – Computer Applications in Health Care and Biomedicine. 5th ed. Springer. ISBN 978-3-030-58720-8 or e-Book ISBN 978-3-030-58721-5. (Required)
- Other articles relevant to the course will be made available.

PREREQUISITES:

N/A

GRADE COMPOSITION:

Attendance: 5%

Homework assignments: 30%

Midterm (proposal for the technical report/term paper and presentation): 25%

Final (technical report and presentation): 40%

Homework assignments:

Students will be asked to read articles in topics related to biomedical informatics and be prepared to lead/actively participate in the discussion in the next course. Homework assignments will include reading relevant papers in the field, submit 300-500 word commentary/review of the reading, and actively participate in class discussions. Details for individual homework assignments will be posted and in the assignments section of Canvas and written components will be submitted through Canvas.

Course project:

The final product of the course is a technical report/term paper on topics relevant to the course, which consists of 65% of overall the grade (midterm 25%, final report + presentation 40%). You can collaborate with other students as a team. However, each team can only have up to two (2) members. Exceptions can only be made with written explanation and subject to the instructor's approval. Please clearly delineate roles and responsibilities of each team member. Your final grade of the course project will be adjusted based on your contribution (e.g., merely presenting the project in the final presentation is NOT a contribution).

Students will be asked to conduct a review of literature relevant to specific area of the course and write a technical report (or a term paper). You are encouraged to come up with novel ideas related to the course. You will conduct extensive background research (e.g., literature review), and you are expected to write a project proposal (the topic you want to do reviews on) and give a presentation during the midterm. Please follow the requirements below for the project proposal and presentation.

Project proposal requirements:

- Cover Page: Include title and list of team members.
- Abstract: Up to 1 page. Explain the motivation for the work to be accomplished.
- Project description: Up to five (5) pages, and please include the following:
 - Specific Aims/Objectives
 - Background and Significance
 - Approach/Research Design (preliminary data and analysis if applicable)
 - Timeline
- Literature cited (no page limit); please follow the JAMIA style.

Proposals must use single column and double spacing; font size no smaller than 11 point; tables and figure labels can be in 10 point; minimum 0.5 inch margins.

Midterm (proposal) presentation:

- Up to fifteen (15) slides and no more than 20 minutes of presentation with 10 minutes Q&A.
- Please send the slides to the instructor at least three (3) days in advance.

Each project team is expected to turn in a final project report, associated code and datasets (or reference to used datasets), and a group presentation.

Project report requirements: the project report can be up to ten (10) pages (excluding references), and please structure the report to include:

- Title (14 point typeface) and names of each team member
- Abstract: no more than 1 page summarizing the project.
- Introduction: background and objective(s) of the study.
- Methods: design, setting, and approaches.
- Results: key findings
- Discussion: key conclusions with direct reference to the implications of the methods and/or results.
- References: please follow the JAMIA style.

Final project presentation:

- Up to fifteen (15) slides and no more than 30 minutes of presentation with 10 minutes Q&A.
- Please send the slides to the instructor at least three (3) days in advance.

Attendance policy:

Class attendance is mandatory. Excused absences follow the criteria of the UF Graduate Catalogue (e.g., illness, serious family emergency, military obligations, religious holidays), and should be communicated to the instructor prior to the missed class day when possible. UF rules require attendance during the first two course sessions. Missing more than three scheduled sessions will result in a failure. Regardless of attendance, students are responsible for all material presented in class and meeting the scheduled due dates for class assignments. Finally, students should read the assigned readings prior to the class meetings and be prepared to discuss the material for each session.

Policy on Use of AI/ChatGPT:

While large language models including ChatGPT have become a popular productivity tool, many publishers and grant funders are limiting or restricting their use in academic products. Given a goal of this course is to develop student's academic skillset, the use of ChatGPT or similar AI/ Large Language Models for source summarization and/or content creation is prohibited in this class. It is expected that all work submitted in this class is the original work of the individual student (or group of students for group assignments).

Grading scale:

Letter Grade	Grade Points	Grade Percentage
A	4.0	95-100
A-	3.67	90-94
B+	3.33	87-89
B	3.0	83-86
B-	2.67	80-82
C+	2.33	77-79
C	2.0	73-76
C-	1.67	70-72
D+	1.33	67-69
D	1.0	63-66
D-	.67	60-62
E	0	< 59

For more detail on letter grades and related University of Florida policies, please see the Grades and Grading Policies at <http://gradcatalog.ufl.edu/content.php?catoid=6&navoid=1219#grades>.

Make-up policy: Students are allowed to make up work only as the result of illness or other unanticipated circumstances. In the event of such emergency, documentation will be required in conformance with University policy. Work missed for any other reason will earn a grade of zero.

UF POLICIES:

University policy on accommodation students with disabilities: Students requesting accommodation for disabilities must first register with the Dean of Students Office (<http://www.dso.ufl.edu/drc/>). The Dean of Students Office will

provide documentation to the student who must then provide this documentation to the instructor when requesting accommodation. You must submit this documentation prior to submitting assignments or taking the quizzes or exams. Accommodations are not retroactive, therefore, students should contact the office as soon as possible in the term for which they are seeking accommodations.

University policy on academic misconduct: Academic honesty and integrity are fundamental values of the University community. Students should be sure that they understand the UF Student Honor Code at <http://www.dso.ufl.edu/students.php>. You are expected and required to comply with the University’s academic honesty policy (University of Florida Rules 6C1-4.017 Student Affairs: Academic Honesty Guidelines, available at <http://regulations.ufl.edu/chapter4/4017.pdf>). Cheating, plagiarism, and other forms of academic dishonesty will not be tolerated. Note that misrepresentation of the truth for academic gain (e.g., misrepresenting your personal circumstances to get special consideration) constitutes cheating under the University of Florida Academic Honesty Guidelines

Netiquette – communication courtesy: All members of the class are expected to follow rules of common courtesy in all email messages, threaded discussions, and chats. The first instance of clearly rude and/or inappropriate behavior will result in a warning. The second instance will result in a deduction of five percentage points from your overall grade. The third instance will result in a drop of a letter grade (A to B, A- to B-, and so on).

GETTING HELP:

For issues with technical difficulties for E-learning in Sakai, please contact the UF Help Desk at:

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

COURSE SCHEDULE (TENTATIVE):

The course schedule, including assigned readings, is subjected to change according to students’ background and interests based on the survey conducted at the beginning of the class. All changes will be updated in Canvas.

Week	Topic	Date	Readings	Homework Due (by 11:59pm the day before class)
1	Introductions, course mechanics/overview, and definition of biomedical informatics Tutorial on systematic review	08/24/2022		
2	Overview of biomedical informatics <ul style="list-style-type: none"> • Foundations of the Field • What is information? 	08/31/2022	Shortliffe, Ch. 1 – Biomedical Informatics Shortliffe, Ch. 2 – Biomedical Data	
3	Overview of biomedical informatics <ul style="list-style-type: none"> • How is biomedical information unique? (part 1) • What is information? Data Standards	09/07/2022	Shortliffe, Ch. 4 Shortliffe, Ch. 7 – Standards in Biomedical Informatics	

4	<p>The electronic health record</p> <p>Clinical research informatics: data warehousing, cohort discovery, secondary data analysis</p> <p>Data at UF: IDR and OneFlorida</p> <p>Guest Lecture: Project management (Speaker: Sonya White)</p>	09/14/2022	<p>Shortliffe, Ch. 14 Electronic Health Records</p> <p>Shortliffe, Ch. 15 – Health Information Infrastructure</p> <p>Shortliffe, Ch 27 – Clinical Research Informatics</p>	Homework #1
5	<p>Cognitive Informatics</p> <p>HCI, Usability, Workflow</p>	09/21/2022	<p>Shortliffe, Ch 4 – Cognitive Informatics</p> <p>Shortliffe, Ch. 5 – HCI</p>	Homework #2
6	<p>Clinical Decision Support</p>	09/28/2022	<p>Shortliffe, Ch. 3 – Biomedical Decision Making: Probabilistic Clinical Reasoning</p> <p>Shortliffe, Ch. 24 - CDS</p>	Homework #3
7	<p>Medical AI and Informatics</p> <p>Guest Lectures: Biomedical Imaging (Ruogu Fang, PhD)</p>	10/05/2022	<p>Shortliffe, Ch. 10 - Biomedical Imaging Informatics</p>	Homework #4
8	<p>Guest Lectures: Bioinformatics (Speaker: TBN)</p>	10/12/2022	<p>Shortliffe, Ch. 9 – Bioinformatics</p>	
9	<p>Midterm presentations</p>	10/19/2022		
10	<p>Ethics in Biomedical and Health Informatics</p>	10/26/2022	<p>Shortliffe, Ch. 12 – Ethics in Biomedical and Health Informatics: Users, Standards, and Outcomes</p>	

	Evaluation of Information Resources		Shortliffe, Ch. 13 – Evaluation of Biomedical and Health Information Resources	
11	Guest Lecture: Clinical natural language processing (Yonghui Wu, PhD)	11/02/2022	Shortliffe, Ch. 8 – Natural Language Processing	Homework #5
12	Patient Safety and the Management of Information in Health Care Organizations	11/09/2022	Shortliffe, Ch. 16 – Management of Information in Health Care Organizations Shortliffe, Ch. 17 – Patient-Centered Care Systems Holden	
13	Health Information Technology Policy Current Trends and Future Directions in Biomedical Informatics: Topic TBD	11/16/2022	Shortliffe Ch. 29 – Health Information Technology Policy	Homework #6
14	Thanksgiving	11/23/2022		
15	Current Trends and Future Directions in Biomedical Informatics: AI, Wearables, and Beyond	11/30/2022	Shortliffe, Ch. 19 – mHealth and Applications	
16	Reading Day – No Class	12/07/2022		
17	Course project final presentations	12/14/2022		

Homework Assignments

1) Read the following article and outline a project idea in your personal area of research or an area of interest to you for future research describing how you would incorporate the strengths of the data trust and limitations your work might face with this data source.

Hogan WR, Shenkman EA, Robinson T, Carasquillo O, Robinson PS, Essner RZ, Bian J, Lipori G, Harle C, Magoc T, Manini L, Mendoza T, White S, Loiacono A, Hall J, Nelson D. The OneFlorida Data Trust: a centralized, translational research data infrastructure of statewide scope. *J Am Med Inform Assoc.* 2022 Mar 15;29(4):686-693. doi: 10.1093/jamia/ocab221. PMID: 34664656; PMCID: PMC8922180.

2) Read the following article and write a brief (300-500 word) summary of how one of the methods described within the article applies to work you are conducting or work that interests you.

Hettinger AZ, Roth EM, Bisantz AM. Cognitive engineering and health informatics: Applications and intersections. *J Biomed Inform.* 2017 Mar;67:21-33. doi: 10.1016/j.jbi.2017.01.010. Epub 2017 Jan 23. PMID: 28126605.

3) Select one of the following articles: Write maximum 500 word commentary on the article including the importance of the work, strengths, limitations, and considerations of future research questions.

Ray S, McEvoy DS, Aaron S, Hickman TT, Wright A. Using statistical anomaly detection models to find clinical decision support malfunctions. *J Am Med Inform Assoc.* 2018 Jul 1;25(7):862-871. doi: 10.1093/jamia/ocy041. PMID: 29762678; PMCID: PMC6016695.

Powers EM, Shiffman RN, Melnick ER, Hickner A, Sharifi M. Efficacy and unintended consequences of hard-stop alerts in electronic health record systems: a systematic review. *J Am Med Inform Assoc.* 2018 Nov 1;25(11):1556-1566. doi: 10.1093/jamia/ocy112. PMID: 30239810; PMCID: PMC6915824.

4) AI in Medicine: Review the following report (read the summary and skim through the report). Select one section (or subsection) of the full report that impacts your area of interest and write a 300-500 word summary of how the section of the report informs or impacts your work.

Matheny ME, Whicher D, Thadaney Israni S. Artificial Intelligence in Health Care: A Report From the National Academy of Medicine. *JAMA.* 2020;323(6):509–510. doi:10.1001/jama.2019.21579

**I don't expect you to read the full report for class, but it can be found at Matheny ME, Thadaney Israni S, Ahmed M, Whicher D. *AI in Health Care: The Hope, the Hype, the Promise, the Peril.* Washington, DC: National Academy of Medicine; 2019. <https://nam.edu/artificial-intelligence-special-publication>.

5) Read the following article, provide a brief (250-400 word) summary of the work, and outline a project idea that would build upon the prior work

Yang X, Chen A, PourNejatian N, Shin HC, Smith KE, Parisien C, Compas C, Martin C, Costa AB, Flores MG, Zhang Y, Magoc T, Harle CA, Lipori G, Mitchell DA, Hogan WR, Shenkman EA, Bian J, Wu Y. A large language model for electronic health records. *NPJ Digit Med.* 2022 Dec 26;5(1):194. doi: 10.1038/s41746-022-00742-2. PMID: 36572766; PMCID: PMC9792464.

6) Policy and Legal Considerations of AI in Medicine: Read the following and provide a 300-500 word commentary on the legal and ethical considerations of AI in Medicine. You may supplement your commentary with additional references if you would like; citations should be included as used and do not count towards your word limit.

Griffin F. Artificial intelligence and liability in health care. *Health Matrix.* 2021;31(1):65-106.

<https://scholarlycommons.law.case.edu/healthmatrix/vol31/iss1/5/>

Clark P, Kim J, Aphinyanaphongs Y. Marketing and US Food and Drug Administration Clearance of Artificial Intelligence and Machine Learning Enabled Software in and as Medical Devices: A Systematic Review. *JAMA Netw Open.* 2023;6(7):e2321792. doi:10.1001/jamanetworkopen.2023.21792