BME|SIE 477|577: Introduction to Biomedical Informatics

Instructor: Vignesh Subbian, PhD | E-mail: vsubbian@email.arizona.edu

Class Time: Tuesday and Thursday – 8:00 am to 9:15 am | Venue: Education Building, Room 349

Office Hours: 60 minutes after class or by appointment

Course Catalog Information: (3 credits) Driven by efforts to improve human health and healthcare systems, this course will cover relevant topics at the intersection of people, information, and technology. Specifically, we will survey the field of biomedical informatics that studies the effective uses of biomedical data, information, and knowledge *from* molecules and cellular processes to individuals and populations, *for* scientific inquiry, problem solving, and decision making. We will explore foundations and methods from both biomedical and computing perspectives, including hands-on experiences with systems, tools, and technologies in the health system.

Prerequisites: A basic course in computing or computer applications (ECE 175, CSC 127A, or equivalent) or consent of the instructor. Learners (including pre-med students and undergraduate biomedical, computer, electrical, systems engineering, and computer science students), trainees, fellows (including clinicians), graduate students, and scientists from all fields with interest in either biomedical and healthcare applications or computing are welcome.

- If you are an undergraduate student in the UA College of Engineering, you must be granted *advanced standing* to enroll in this course.
- If you are a student/trainee from outside of the UA College of Engineering, please talk to the instructor to discuss your interests and obtain consent to enroll.

Course Reference Textbooks:

- Shortliffe, E. H., & Cimino, J. J. (2013). Biomedical Informatics: Computer Applications in Health Care and Biomedicine. Springer Science & Business Media, (4th Edition).
- Selected readings from peer-reviewed literature in biomedical informatics, translational medicine, and healthcare systems engineering.

Course Topics:

This is a tentative list of topics. Some modules are subject to change.

Part I: Foundations and Themes

1. The Science and Pragmatics of Biomedical Informatics
2. Acquisition, Storage, and Use of biomedical data (including “big data”)
3. Standards in Biomedical Informatics
4. Biomedical Decision Making
5. Natural Language Processing in Health care and Biomedicine
6. Ethics in Biomedical and Health Informatics: Users, Standards, and Outcomes
7. Introduction to Methodologies in Biomedical Informatics

Part II: Applications

8. Bioinformatics and Translational Bioinformatics
9. Biomedical Imaging Informatics
10. Clinical Informatics and Electronic Health Record Systems
11. Clinical Research Informatics
12. Public Health Informatics

Part III: Trends

13. Evidence-based Practices, Technology-related Policies in Healthcare
14. Emerging Technologies and the Future of Informatics in Biomedicine

Course Learning Outcomes:

At the end of this course, each trainee/student will be able to

(1) Understand the different sub-disciplines of biomedical informatics (BMI) and identity an area of interest for further study, research, and/or practice (h).
(2) Comprehend how to acquire, store and maintain, retrieve, analyze, and meaningfully use biomedical data (a, b).
(3) Apply biomedical and computational tools and technologies to solve problems in biomedicine and healthcare (a, e, k).
(4) Understand how technology, including health information systems and medical devices, can improve or limit the ability to provide clinical care (a).
(5) Critically think and develop own perspectives on ethical and legal considerations in use of contemporary technology and informatics in health care (j, f).

Additionally, graduate students will be able to

(6) Identify, understand, and interpret evidence from biomedical informatics literature/research.
(7) Conceptualize and utilize informatics-based tools in one of the sub-disciplines identified in (1) for clinical practice or research.

Assessment of Learning

Projects (65%)

There will be both individual project(s) (15%) and team projects (50%). Please note that each project will be weighted based on time and effort involved. Graduate students will have an additional research project to complete: This project will involve identification of a topic and problem of interest in one of the informatics sub-disciplines, systematic review of literature pertinent to the problem, and producing engineering, design, and/or analytical solutions.

UnLectures (30%)

UnLectures are activities designed to (1) create meaningful connections between your learning experience in this course and your real-world experiences such as internship, research, and other experiential learning and/or (2) promote critical thinking and reflection on key topics of interest to the

course. Each UnLecture will involve an in-class discussion session and pre- and post-session written reflections. There will be 5 - 6 UnLectures (typically on a biweekly basis). More specific details will be provided 1-week prior to an UnLecture.

Quizzes (5%)

There will be short in-class quizzes during the course of the semester. Tentative dates for the quizzes will be announced during the second week of the semester.

Assessment Scale:

The final letter grade will be based on UA's standard grading scale and assigned as follows. The minimum overall total (lower limit) may be lowered, but will not be raised.

A: 90 to 100 | B: 80 to 89.99 | C: 70 to 79.99

D: 60 to 69.99 | E: 0 to 59.99

Statement of Inclusion

As a highly interdisciplinary course, the *diversity*** of participants in this course is a valuable source of ideas, problem solving, and engineering creativity. If you feel that your contribution is not being valued for any reason, please speak with me privately. If you wish to communicate anonymously, you may do so in writing or speak with Diana Wilson or Danielle Embry. As members of the UA community, it is our shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.

***includes every participant's identity, personal and academic/professional background (includes technical/clinical experience, internship/co-op/research experience), interests, and expertise.*

Statement of Personal Challenges and Preferences

- It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Resources (520-621-3268) to establish reasonable accommodations.
- Also, I will gladly honor any request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Course Policies

- **Team Work:** For team projects, students are required to work on teams of 2 or 3. Students' background and prior experience will be used to form teams. Every member of the team is expected contribute equally to the project. The entire team will share the same score for each release; however, if the instructor/members identify others who have not contributed (or have contributed above and beyond), the scores will be varied accordingly.
- **Extra Credit:** Extra credit opportunities (if any) will be announced in class.
- **Submission Policies:** All project-related submissions are due at 11.59 pm on the day specified on the write-up (usually Saturdays). Late submissions will receive 80% credit after the due date. Late submissions beyond one week after the due date will receive 10% credit.

- **Make-up Policy:** Make-up quizzes may be given in case of illness or personal emergencies. In case of illness, a written and signed note from the physician is required.
- **Audit Policy:** Students auditing this course should 1) work with one of the project teams and submit a report summarizing their experience in each assigned project, 2) attend and complete at least 2 UnLecture activities
- **Academic Integrity:** Every student/student team should strive for honest and responsible conduct. All forms of academic misconduct including, but not limited to, plagiarism, unauthorized collaboration, and fabrication are strictly prohibited. Failure to adhere to these guidelines will be dealt with as recommended in the UA Student Code of Conduct and the submission/activity under consideration will receive 1% credit.
- **Grievance Policy**: All course-related grievances should be communicated in writing. See *Statement of Inclusion* for related information.
- **Statement of Changes to Syllabus**: Information contained in this course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.
- **General Policies**: All policies and codes approved by the dean of students apply to this course.
    - *Absence Policy:* Absences for any sincerely held religious belief, observance, or practice will be accommodated where reasonable. Absences pre-approved by the UA Dean of Students (or dean's designee) will be honored.
    - *Classroom Behavior Policy:* See Statement of Inclusion
    - *Threatening Behavior Policy:* The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself.
    - *Nondiscrimination and Anti-harassment policy:* UA is committed to creating and maintaining an environment free of discrimination. See statement of inclusion and further details here.
