



ACAD 362 Analytics for Health Innovators

Units: 4
Meeting Times: Monday and Wednesday, 3:00 pm – 4:50pm

Instructor: Michael Crowley
Office: crowley@usc.edu
Office Hours: Wed, 12:00–2:00 pm

Course Description

The growing healthcare industry is generating a large volume of useful data on patient demographics, treatment plans, payment, and insurance coverage—attracting the attention of clinicians and data scientists alike. This course will introduce students to various sources of health data and discuss how to apply various statistical techniques to mine useful information and knowledge that is then applied to clinical practice, healthcare administration and various patient disease treatment and therapies. We will also explore how “intelligent hospitals” are utilizing analytics and deploying them across the industry to become more strategic and efficient in order to provide better healthcare at a lower cost. We will emphasize on the design aspects of building innovative health applications that are fueled by analytics in the backend.

Learning Objectives

By the end of this course, students should be able to:

- Explain how data is converted to knowledge and insights
- Demonstrate good understanding of various statistical techniques applied to health data
- Understand various health analytics models and their adoption by medical practitioners
- Deal with EHR data, biomedical signal data, sensor and IoT data and other types of health data to mine for patterns and insights
- Understand design challenges in incorporating analytics in medical information/decision systems
- Go to the real world and conduct research on how hospitals and healthcare institutions are implementing data analytics

Required Readings:

[1] *Storytelling with Data: A Data Visualization Guide for Business Professionals*, by Cole Nussbaumer Knaflic, published 2015 by Wiley

[2] Jeffrey D. Camm, James J. Cochran, et al., *Business Analytics*, 3rd edition. Published by Cengage Learning, 2018

Optional Reading:

Chandan K. Reddy, Charu C. Aggarwal. *Healthcare Data Analytics* (Chapman & Hall/CRC Data Mining and Knowledge Discovery Series) (Hardcover), 1st edition

RapidMiner Tool

In this course you will learn and use RapidMiner, an open-source GUI-based data mining tool. Students will be able to implement a step-by-step process for predicting an outcome or discovering hidden relationships from the data using RapidMiner.

You can download RapidMiner Studio from <https://rapidminer.com/products/studio/>

Grading Breakdown

In-class activities	10%
Labs	40%
Midterm	25%
Final Project	25%
Total	100%

Grading Scale

Course final grades will be determined using the following scale.

A	93-100
A-	90-92
B+	88-89
B	83-87
B-	80-82
C+	78-79
C	73-77
C-	70-72
D+	68-69
D	63-67
D-	60-62
F	59 and below

Course Structure

Students are expected to:

- Complete weekly labs, readings, in-class activities, and final project

Students are responsible for completing assigned work by stated deadlines.

Policies

Due dates and requirements for all assigned work will be posted on the course site on Blackboard.

It is the student's responsibility to post work by the due date following the defined class procedures, even if you miss class. Work turned in late will be assessed the following penalties:

- Up to 24 hours late: 20% deduction
- 24 to 48 hours late: 50% deduction
- After 48 hours, zero score.

Academy Student Attendance Policy

The Academy maintains rigorous academic standards for its students and on-time attendance at all class meetings is expected. Each student will be allowed two excused absences over the course of the semester for which no

explanation is required. Students are admonished to not waste excused absences on non-critical issues, and to use them carefully for illness or other issues that may arise unexpectedly. Except in the case of prolonged illness or other serious issue (see below), no additional absences will be excused. Each unexcused absence will result in the lowering of the final grade by 1/3 of a grade (e.g., an A will be lowered to A-, an A- will be lowered to B+, etc.).

Students remain responsible for any missed work from excused or unexcused absences. Immediately following an absence, students should contact the instructor to obtain missed assignments or lecture notes and to confirm new deadlines or due dates. Extensions or other accommodations are at the discretion of the instructor.

Automatically excused absences normally may not be used for quiz, exam or presentation days. Using an excused absence for a quiz, exam or presentation, such as in the case of sudden illness or other emergency, is at the discretion of the instructor.

In the case of prolonged illness, family emergencies, or other unforeseen serious issues, the student should contact the instructor to arrange for accommodation. Accommodation may also be made for essential professional or career-related events or opportunities. All accommodations remain at the discretion of the instructor, and appropriate documentation may be required.

Fall 2022 addendum:

- Unless students provide an accommodation letter from USC's Office of Student Accessibility Services (OSAS) or a letter from IYA Student Services detailing visa or travel restrictions, attendance and active participation is expected in the classroom. Any student with such accommodations should submit their accommodation document to the instructor as soon as possible to discuss appropriate accommodations. Either classroom recordings or live remote access to the class via Zoom will be provided.
- Students who are experiencing illness should not attend class in person. Please inform the instructor in advance of any class sessions that you can't attend for medical reasons, and accommodations will be arranged to view recorded lectures and submit alternatives to any missed class participation. Students will not be penalized for not attending class in person under these circumstances.
- In the event that you find yourself experiencing COVID-19 related symptoms, in keeping with university recommendations, you should Stay home! This is the best way to prevent spreading COVID-19 as supported by scientific evidence; Please do not come to an in-person class if you are feeling ill, particularly if you are experiencing symptoms of COVID-19.

Course Schedule: A Weekly Breakdown

	Topic/Daily Activities	Readings and Homework	Labs/Assignments (week assigned)
Week 1	Introduction to Analytics Methods and Models; Introduction to RapidMiner; In-class activity Overview of Healthcare Analytics; Healthcare Analytics Failure: Case Study	Camm et al., Chapter 1 Reddy et al. Chapter 1	Lab 1
Week 2	Descriptive Statistics; In-class activity Electronic Health Records: A Survey	Camm et al., Chapter 2 Reddy et al., Chapter 2	Lab 2
Week 3	No class on Monday – Labor Day Data Visualization; In-class activity	 Knafflic, Chapters 1 and 2	Lab 3
Week 4	Descriptive Data Mining; In-class activity Data Visualization; In-class activity	Camm et al., Chapter 4 Knafflic, Chapters 3 and 4	Lab 4
Week 5	Probability: An Introduction to Modeling Uncertainty; In-class activity Data Visualization; In-class activity	Camm et al., Chapter 5 Knafflic, Chapters 5 and 6	Lab 5
Week 6	Statistical Inference; In-class activity Data Visualization; In-class activity	Camm et al., Chapter 6 Knafflic, Chapters 7 - 9	Lab 6
Week 7	Linear Regression; In-class activity Midterm Review	Camm et al., Chapter 7	
Week 8	Mining of Sensor Data in Healthcare: A Survey Midterm Exam	Reddy et al., Chapter 4	Lab 7

Week 9	Time Series Analysis and Forecasting; In-class activity Genomic Data Analysis for Personalized Medicine	Camm et al., Chapter 8 Reddy et al., Chapter 6	Lab 8
Week 10	Predictive Data Mining; In-class activity Social Media Analytics for Healthcare	Camm et al., Chapter 9 Reddy et al., Chapter 9	Final Project Part1
Week 11	Monte Carlo Simulation; In-class activity Temporal Data Mining for Healthcare Data	Camm et al., Chapter 11 Reddy et al., Chapter 11	
Week 12	Linear Optimization Models; In-class activity Visual Analytics for Healthcare	Camm et al., Chapter 12 Reddy et al., Chapter 12	Final Project Part2
Week 13	Integer Linear Optimization Models; In-class Activity Information Retrieval for Healthcare	Camm et al., Chapter 13 Reddy et al., Chapter 14	
Week 14	Nonlinear Optimization Models; In-class Activity Thanksgiving Break – no class on Wednesday	Camm et al., Chapter 14	Final Project Part 3
Week 15	Decision Analysis; In-class Activity Clinical Decision Support Systems	Camm et al., Chapter 15 Reddy et al., Chapter 19	
Dec 12 2 – 4pm	Final Exam Period – Final Project Presentations		

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu