

Syllabus

IE 662– Preventive Analytics for Decision Making

Fall 2022

Instructor	Dr. Luis Segura Office JS-312 Office hours: Monday and Wednesday, from 12:00 am to 01:00 pm
GTA	Naresh Koju Office: TBD Office hours: TBD
Lecture	Monday and Wednesday 04:00 pm to 5:15 pm, JS 203
Textbook	Zhang <i>et al.</i> , Dive into Deep Learning, Online Available: https://d2l.ai/ Rencher <i>et al.</i> , Linear Models in Statistics. John Wiley & Sons, 2008. This book can be downloaded at http://www.utstat.toronto.edu/~brunner/books/LinearModelsInStatistics.pdf Friedman J <i>et al.</i> , The Elements of Statistical Learning. New York, NY, USA, 2009. This book can be downloaded at https://web.stanford.edu/~hastie/ElemStatLearn/
Prerequisites	IE 560 (Probability and Statistics) or similar course

Course Description

This course will prepare students with various predictive analytics methods for manufacturing, healthcare, etc., which will be illustrated in examples. Different data types from real-world examples will be shown. Subsequently, it will be demonstrated how the predictive analytics methods can be used for better decision making. The methods will be implemented in non-programming based – standard software such as Matlab, Excel, and Minitab.

Learning Objectives

After taking this course, Students should be able to do the following:

- Understand the basics of predictive analytics
- Define the modeling and analysis problems in manufacturing, healthcare, etc.
- Implement the methods in non-programming based software (e.g., Excel, Minitab, Matlab)
- Use the results to enable decision making in each problem context
- Develop critical analysis on various preventive modeling approaches and their applications in industry
- Identify potential research areas on preventive analytics for decision making

Grading Scale:

A+ = 97 to 100%	A = 93 to < 97%	A - = 90 to < 93%
B+ = 87 to < 90%	B = 83 to < 87%	B - = 80 to < 83%
C+ = 77 to < 80%	C = 73 to < 77%	C - = 70 to < 73%
D+ = 67 to < 70%	D = 63 to < 67 %	D - = 60 to < 63%
Below 60% = F		

Grade Basis	Homework	10%
	Project Phase I	10%
	Project Phase II	20%
	Project Phase III	20%
	Test 1	30%
	Review Paper	10%
	Bonus	5%

Students with Disabilities

If you need accommodations because of a disability, please contact the Disability Resource Center <http://louisville.edu/disability> and communicate with the instructor by email no later than the first week of class.

General Communication Procedures

Communications will be sent to students' official university email addresses. It is the responsibility of students to check their University mailboxes on a regular basis. While sending an email to instructor, it is needed to put **IE662** in the subject of the email.

Academic Integrity Policy

Students are encouraged to work together and learn from each other. However, cheating in any form will not be tolerated. Refer to the Speed School Academic Integrity Statement located at:

<http://louisville.edu/speed/academics/academicDishonesty>

Class Policy

The honor system is an important part of your education at University of Louisville. I consider honor to be one of the highest traits of human character. As such, it is important that I make clear what is permissible with regards to student cooperation and working together.

Contingency Plans

- If the university transitions ALL courses to 100% online, a MS Teams meeting link will be provided on Bb to support online teaching. Video recordings will be provided on Bb.
- If a student falls ill or must quarantine, an email notification should be sent to the instructor ASAP. Compensation will be provided case-by-case.
- If the instructor falls ill, the GTA or a guest speaker will be invited to give lecture(s).

Homework Assignments

- Homework assignments (including reading assignments) are open book and open notes. You can use your laptops, too.
- Homework assignments can be online (i.e., on Bb) or in hard-copy format.
- **Any online resources should be acknowledged (i.e., cite in APA format¹).**

Test

- Test will be closed book. You will be allowed to bring a calculator and **one sheet (8.5" x 11")** of notes, formulas, or examples to each test. You may write on both sides of the paper.
- No computer (e.g., laptop, tablet, phone) is allowed during a test.
- Test is to be an individual effort. There will be no communication of any kind (talking, sharing notes, sharing calculators, etc.) with anyone else.
- If I observe suspicious behavior during a test, I will remove you from the classroom and you will complete your test in an isolated location.
- Test missed in case of special situations (e.g. illness) may be considered on a case-by-case basis, pending submission of supporting documentation.

Project

- Project will be assigned in three phases:
 - Phase I: Project proposal, including problem definition, data plan, background, comprehensive literature review.
 - Phase II: Project methodology and evaluation, including methodology development, performance evaluation in numerical experiments, benchmark comparison.
 - Phase III: Project report in a paper format
- Project should be completed individually
- Project deliverables should be submitted on Bb

¹https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/in_text_citations_the_basics.html#:~:text=When%20using%20APA%20format%2C%20follow,the%20end%20of%20the%20paper.

Review Paper

- Review paper should cover data modeling approaches improvements and applications to manufacturing, healthcare, etc.
- Review paper should be submitted on Bb

Use of Blackboard

I will use Blackboard (Bb) to post the syllabus, lecture notes, and announcements. I also use the Bb gradebook to post all your grades. Please check your grades in Bb to make sure I have the proper grade recorded for each assignment. Also, I will often use Bb to email messages to the entire class or select students – it is your responsibility to check your UofL email account regularly for these messages.

Technology Required for Class:

- A mobile computer to play with computer programs (e.g., Minitab, Excel, Matlab)
<http://louisville.edu/speed/academics/tabletPC>

Title IX/Clery Act Notification

Sexual misconduct (including sexual harassment, sexual assault, and any other nonconsensual behavior of a sexual nature) and sex discrimination violate University policies. Students experiencing such behavior may obtain **confidential** support from the PEACC Program (852-2663), Counseling Center (852-6585), and Campus Health Services (852-6479). To report sexual misconduct or sex discrimination, contact the Dean of Students (852-5787) or University of Louisville Police (852-6111).

Disclosure to University faculty or instructors of sexual misconduct, domestic violence, dating violence, or sex discrimination occurring on campus, in a University-sponsored program, or involving a campus visitor or University student or employee (whether current or former) is **not confidential** under Title IX. Faculty and instructors must forward such reports, including names and circumstances, to the University's Title IX officer. For more information, see <http://louisville.edu/hr/employeerelations/sexual-misconduct-brochure>.

Computer Issues and IT Support: Speed IT staff are available by appointment from 9 am to 4 pm to assist you with your technology needs. You may schedule an appointment by sending a detailed email including any relevant error codes and screen snips at SPDHelp@Louisville.edu (preferred) or 502-852-7620.

COVID-related

As a Community of Care, all Cardinals are expected to abide by public health guidelines and regulations as published by the University. For **Fall 2022**, this includes:

- 1) wearing of cloth/paper masks (covering nose and mouth) when in shared indoor spaces like classrooms. (Per the July 2020 code of student conduct, [a student who refuses to follow these guidelines may be asked to leave a classroom](#)).
- 2) staying home when sick—any UofL community member experiencing fever, consistent dry cough, or other symptoms of contagious disease should remain at home until symptoms subside or advised that it is safe to return by a medical professional.
- 3) practicing good hygiene and responsibility for one's own surrounding.
 - a. Cover sneezes and coughs
 - b. Wash hands frequently with soap and water when possible, use hand sanitizer when soap and water are not available
 - c. Wipe down frequently touched surfaces
 - d. Maintain 6 feet physical distancing when possible

Faculty have the responsibility to help students meet these recommendations by:

- 1) SSoE instructors will allow students absent for reason of illness and/or quarantine to make up missed work and not penalize students for these absences
- 2) Notifying physical plant when classrooms are not adequately stocked with cleaning supplies and arranging classroom furniture or seating charts to maximize physical distancing where possible.

Topics

Topics covered in this course:

- T1: Introduction to predictive analytics
- T2: Types of data (e.g., signals, videos, images, etc.)
- T3: Decision making in real world (e.g., applications in manufacturing, health, etc.)
- T4: Preliminaries
 - Data manipulation
 - Data preprocessing
 - Basic linear algebra
 - Basic calculus
 - Probability
- T5: Ethics in data analysis
- T6: Data preparation and cleansing (e.g., Excel, MatLab, etc.)
- T7: Descriptive statistics
 - Data visualization (e.g., Excel, Minitab, Tableau, etc.)
 - Data reduction (e.g., R, Matlab, Excel, etc.)
- T8: Regression (e.g., Minitab, R, Matlab, etc.)
 - Linear regression
 - Multiple regression
- T9: Classification (e.g., Minitab, R, Matlab, etc.)
 - Logistic regression
 - Decision tree
 - Bagged and boosted approaches
- T10: Clustering (e.g., Minitab, R, Matlab, etc.)
 - Methods (centroid, density, hierarchical, etc.)
 - K-means, K-medoids, SVM, etc.

Week	Date	Monday	Wednesday
1	22-Aug	Syllabus, T1	T2
2	29-Aug	T3	T3
3	5-Sep	Labor Day (No Class)	Project Phase I – Project Proposal
4	12-Sep	Project Phase I – Project Proposal	T4
5	19-Sep	T4 (ICP 1)	T5
6	26-Sep	T5 (ICP 2)	T6
7	3-Oct	Mid-term Break	T6 & Project Phase II – Project Progress (In-person Session)
8	10-Oct	Review of T1~6	Test (Bonus Question)
9	17-Oct	INFORMS	INFORMS
10	24-Oct	T7	T7
11	31-Oct	T7	T8
12	7-Nov	T8	T8
13	14-Nov	T9	T9 (ICP)
14	21-Nov	T10 & Project Phase III – Project Final Revision (In-person Session)	Thanksgiving
15	28-Nov	Project Presentation	Project Presentation
16	05-Dic	Paper Review / Project Reports (Presentation, data, analysis files, etc.)	

Note: Instructor reserves the right to make changes in the syllabus, if needed. Students will be notified of the changes via their university emails, Bb or in class.