

ISYE 436/536: Applied Regression Analysis for Engineering

Syllabus

Term: Spring 2021

Credit hours: 3

Classroom: Online

Time: Asynchronous

Instructor: Dr. Ziteng Wang

- **Office:** EB 240
- **Email:** zwang3@niu.edu

Office hour: by email appointment

Teaching assistant: See Blackboard

Course description: (NIU Undergraduate and Graduate Catalogs) Statistical techniques for modeling, designing, and investigating relationships among variables in engineering processes. Engineering applications of linear regression with one predictor variable, multiple linear regression, and forecasting and time series analysis.

Prerequisites:

- ISYE 335, or equivalent, or consent of department.
- Basic computer programming skills

Textbook:

- *Linear Regression Using R: An Introduction to Data Modeling*, David J. Lilja, University of Minnesota Libraries Publishing, Minneapolis, 2016.
This book is an “open textbook”, meaning that you may download for learning purposes for free.
Link: <https://z.umn.edu/lrur>
- *An Introduction to Statistical Learning with Applications in R*. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani. Springer. 2013.
You may download and use this book for learning purposes for free. Link: <https://statlearning.com/>

Course objective: Upon completion of this course, a student should be able to do the following:

- Write programs in R
- Understand regression models and methods
- Develop appropriate regression models to analyze data

Relation to graduate program outcomes. This course contributes to the following outcomes of the graduate program:

- A. An ability to define and formulate Industrial and Systems Engineering problems.

- B. An ability to apply math and scientific tools to define, design, predict, improve, and optimize the system performance.
- C. An ability to independently learn advanced topics in Industrial and Systems Engineering.
- D. An ability to conduct research or project professionally and ethically.
- E. An ability to effectively communicate ideas/concepts and research findings through technical reports and professional presentations.

Course topics: The following topics will be covered in this course:

- R programming
- Simple linear regression
- Multiple linear regression
- Prediction with regression
- Logistic regression
- Cross-validation
- Model selection and regularization
- Nonlinear regression
- Regression trees

Assignments and Grading:

- Homework: 30%
 - Homework must be completed individually.
 - No late homework will be accepted.
 - Some homework assignments use DataCamp. Use the link provided by the instructor to join the organization “Applied Regression Analysis”.
- Mini project 1: 20% + Mini project 2: 20%
 - Students must complete the mini projects individually or by a team of two.
 - The mini projects are case studies. Students are expected to develop regression models to analyze data, answer questions and report their findings.
 - Case and data will be provided by the instructor.
 - Each team should submit a report that documents their work and findings.
 - Report for mini project 1 is due on **Sunday 03/07, 2021 11:59pm.**
 - Report for mini project 2 is due on **Sunday 04/18, 2021 11:59pm.**
 - Additional requirements are posted on Blackboard.
- Competition project: 30%
 - Students must complete the competition project individually or in the same team as mini projects.
 - Students will enter a Kaggle competition. Use regression analysis to make prediction on a given dataset. Ranking is based on prediction accuracy.
 - A report is due on **Thursday 04/29, 2021 11:59pm.**
 - A recorded presentation is due on **Thursday 04/29, 2021 11:59pm.**
 - Additional information and requirements are posted on Blackboard.
- There will be no exam.
- Each student will receive a letter grade based on his or her cumulative percentage score according to the following scales:
 - A 95 – 100
 - A- 90 – 94.99

- B+ 85 – 89.99
- B 80 – 84.99
- B- 70 – 79.99
- C+ 60 – 69.99
- C 50 – 59.99
- C- 40 – 49.99
- D 30 – 39.99
- F 0 – 39.99

Tentative course schedule:

Week	Date	Topics	Module	Reading	Assignments
1	01/11 – 01/17	Course overview; Introduction to R	0, 1	OpenBook Ch. 1	HW1: Introduction to R
2	01/18 – 01/24	Introduction to R	1	OpenBook Ch. 2 ISLR Sec. 2.3	HW2: Work with data in R; HW1 due
3	01/25 – 01/31	Simple linear regression	2	OpenBook Ch. 3	HW3: Simple linear regression; HW2 due
4	02/01 – 02/07	Multiple linear regression	3	OpenBook Ch. 4	HW4: Multiple linear regression; HW3 due
5	02/08 – 02/14	Prediction with regression	4	OpenBook Ch. 5,7	HW5: Prediction and train/test; HW4 due
6	02/15 – 02/21	Additional topics on linear regression	5	ISLR Ch. 1, 2, 3	HW6: Linear regression wrap-up; HW5 due
7	02/22 – 02/28				
8	03/01 – 03/07	Mini project 1			Mini project 1 report due
9	03/08 – 03/14	Logistic regression	6	ISLR Ch. 4	HW7: logistic regression; HW6 due
10	03/15 – 03/21	Cross-validation	7	ISLR Ch. 5	HW8: cross-validation HW7 due
11	03/22 – 03/28	Model selection and regularization	8	ISLR Ch. 6	HW9: Model selection and regularization; HW8 due
12	03/29 – 04/04	Nonlinear regression	9	ISLR Ch. 7	HW10: nonlinear regression; HW9 due
13	04/05 – 04/11	Regression trees	10	ISLR Ch. 8	HW11: regression trees; HW10 due
14	04/12 – 04/18	Mini project 2			Mini project 2 report due
15	04/19 – 04/25	Wrap-up			HW11 due
16	04/26 – 05/02	Exam week			Competition project report and presentation due

Academic integrity: Good academic work must be based on honesty. The attempt of any student to present as his or her own work that which he or she has not produced is regarded by the faculty and administration as a serious offense. Students are considered to have cheated if they copy the work of another during an examination or turn in a paper or an assignment written, in whole or in part, by someone else. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging those sources or if they paraphrase ideas from such sources without acknowledging them. Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, or examination may receive a grade of F for the course involved and may be suspended or dismissed from the university.

Each student is responsible to know and observe the university academic regulations that can be found in the Undergraduate Catalog and Graduate Catalog.

- Undergraduate: [link](#)
- Graduate: [link](#)

Accommodations for students with disabilities: If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or drc@niu.edu.

Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

Syllabus change policy: This syllabus is a guide and every attempt is made to provide an accurate overview of the course and its requirements. However, certain circumstances may make it necessary for the instructor to modify the syllabus during the semester for the benefit of the students and the changes may depend, in part, on course progress and students' needs. Changes to the syllabus will be made with advance notice to students and approval by the department.