

Mathematical Foundations for Data Science for Engineers II

EGN 6446, 3 credit hours

Class Periods: T| Period 5-6 (11:45AM – 1:40PM)
R| Period 6 (12:50PM – 1:40PM)

Location: NEB 0100

Academic Term: Spring 2025

Instructor:

Rui Guo, Ph.D.

rui.guo@ufl.edu

Office Location: 515 Weil Hall

Office Hours: R 11:00AM-12:30PM, or by appointment

Teaching Assistants:

None

Course Description

Understand and apply machine learning statistical models including functions of random variables, Monte Carlo, convergence, estimation, and hypothesis testing. Understand and apply optimization algorithms including constrained and unconstrained, first and second order, stochastic and gradient descent, and nonconvex.

Grading Scheme: Letter Grade

Statistical methods for modeling and analyzing structured data. Optimization algorithms typically encountered in applied machine learning. Case studies involving application of course topics.

Course Pre-Requisites / Co-Requisites

EGN5446 Mathematical Foundations for Data Science for Engineers

Course Objectives

Understand and apply machine learning statistical models including functions of random variables, Monte Carlo, convergence, estimation, and hypothesis testing. Understand and apply optimization algorithms including constrained and unconstrained, first and second order, stochastic and gradient descent, and nonconvex.

Materials and Supply Fees

None Required

Required Textbooks and Software

Required Software: Python IDE (e.g., VS Code, Jupyter Notebook)

Recommended Materials

Murphy, K. P. (2022). Probabilistic machine learning: an introduction. MIT press. ISBN-13: 978-0262046824

Anil Ananthaswamy (2024). Why Machines Learn: The Elegant Math Behind Modern AI. Dutton. ISBN-13: 978-0-593-18574-2

Jeremy Watt, Reza Borhani, Aggelos K. Katsaggelos (2020). Machine Learning Refined: Foundations, Algorithms, and Applications, 2nd Edition. ISBN-13: 978-1108480727

Dennis Wackerly, William Mendenhall, Richard L. Scheaffer. Mathematical Statistics with Applications, 7th Edition (8th Edition coming March 2025). Cengage Learning. ISBN-13: 978-0495110811 (8th: 979-8214013527)

Edwin K.P.Chong, Wu-Sheng Lu, Stanislaw H.Zak (2023). An Introduction to Optimization: With Applications to Machine Learning, 5th Edition. Wiley. ISBN-13: 978-1119877639

Required Computer

UF student computing requirement: <https://news.it.ufl.edu/education/student-computing-requirements-for-uf/>

EGN 6446: Math Foundation II for DS

Rui Guo, Spring 2025

Course Schedule (Tentative)

Week 1: Review of Probability, Functions of Random Variables
Week 2: Statistics – Sampling Distributions
Week 3: Statistics – Point Estimation, Estimation Methods
Week 4: Statistics – MLE, MAP
Week 5: Statistics – Confidence Intervals, Hypothesis Testing
Week 6: Statistics – Regression and Correlation
Week 7: Linear Model Estimation: various approaches
Week 8: Optimization – Basics / **Exam 1**
Week 9: Optimization – Convexity, First-Order methods
Week 10: Spring Break (No Class)
Week 11: Optimization – Gradient Decent, SGD
Week 12: Optimization – Second-Order methods
Week 13: Constrained Optimization – Lagrangian, KKT
Week 14: More about Optimization / **Exam 2**
Week 15: The Elegant Math Behind Modern AI

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance Policy

Excused absences are in compliance with university policies and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Exercises	100 each	15%
Quizzes	10 each	10%
Exam 1	100	30%
Exam 2	100	30%
Project	100	15%
		100%

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 - 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 77.9	C+	2.33
72.0 - 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

[UF Graduate Catalog](#)

[Grades and Grading Policies](#)

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is

important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the

Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.
Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.