ECE-UY4563 Introduction to Machine Learning

Fall 2025

Department of Electrical and Computer Engineering
New York University, Tandon School of Engineering

Instructor	Nikola Janjušević
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Class Hours	Mon., Wed. 12:30-2:00pm, 2 Metrotech Center, Room 801
Office Hours	online and by appointment
Textbooks	– James, Witten, Hastie, Tibshirani, and Taylor, *"An Introduction to Statistical Learning"*, Springer, 2023. – Hastie, Tibshirani, and Friedman, *"Elements of Statistical Learning: Data Mining, Inference, and Prediction."*, Springer, 2009. – Tivandar Danka, *"Mathematics of Machine Learning"*, Packt, 2025.
(advanced)	– Christopher M. Bishop, *"Pattern Recognition and Machine Learning"*, Springer, 2006.
Course website	Grades+Submission: NYU Brightspace Admin: nikopj.github.io/teaching/introml25 Labs+Probs: github.com/nikopj/introml

The following is adapted from Professor Sundeep Rangan's Syllabus for previous versions of this course.

Course Description : This course provides a hands-on approach to machine learning and statistical pattern recognition. The course will describe fundamental algorithms for linear regression, classification, model selection, support vector machines, neural networks, dimensionality reduction and clustering. The course includes demos and labs on real and synthetic data using Python. Applications will be demonstrated in audio and image processing, robotic control, gene expression data, neural decodings and text processing. No prior machine learning experience is required. Students will learn to: Formulate problems using a variety of simple ML models. Use software packages to train and validate models. Analyze the performance of these methods using tools from optimization and probability. Pre-process data and visualize results from different sources (time series, audio, image, text, etc.).

Course Learning Objectives:

1. Formulate a task as a machine learning problem
2. Identify learning objectives, source of data, models, ...
3. Load, pre-process and extract features from common data sources: images, text, audio
4. Mathematically describe simple models of the data
5. Fit the models to data and use models for prediction and estimation (using common tools)
6. Evaluate goodness of fit and refine models
7. Evaluate the performance of methods using statistical techniques

Grading Scheme:

Labs+Homework	25%
Midterm Exam	25%
Final Exam	25%
Final Project	25%

1. **Class Conduct, Lab Conduct, and Participation**: You are expected to contribute to discussions related to course material throughout the semester in a manner respectful to your instructor and classmates. This can be in the form of answering/posing questions during class and/or office hours.

   You are expected to attend all lectures. Please notify me beforehand of any planned absence.

   Deductions may incur for violations of classroom conduct and/or technology policy (see Grading Scale below).

2. **Homework**: Labs and Problem sets will be given during each unit. Both will be due in NYU Brightspace *before* class on the due date.

3. **Exams**: Written midterm and final exams will test your understanding of course material and principles. Exams will be administered during class hours.

Grading Scale:

90 - 100	A – superior and comprehensive understanding of the course principles
80 - 89	B – good degree of familiarity of the course principles
70 - 79	C – average knowledge of course principles and fair performance
60 - 69	D – minimum working knowledge of the course principles
< 60	F – unsatisfactory understanding of the course principles

Technology Policy: Please bring your laptop to class. We will be doing in class excersises in Python.

Group Work and Academic Integrity: You are encouraged to discuss your homework and projects outside of class time with your classmates, however, all work submitted must be your own. You are required to acknowledge collaboration with other parties (including a website or textbook reference) in arriving at your answers/explanations in homework and projects. Submitted work that is strongly suspected of being misrepresented as your own (i.e. plagiarism, including copying the output of generative AI) will be reported to the Dean's Office and may result in a zero on the assignment/exam and/or a D/F in the course.

Course Schedule (tentative): Below is an outline of the course schedule, subject to change.

#	Dates	Topics	Unit	Assignments
1	09/03	Course Overview Simple Linear Regression	1, 2	HW1: Install and run a Jupyter Notebook with Plotting.
2	09/08, 09/10	Multiple Linear Regression	3	U2 Lab+Prob due.
3	09/15, 09/17	Model Selection	4	U3 Lab+Prob due.
3	09/22, 09/24	Regularization and LASSO	5	U4 Lab+Prob due.
4	09/29, 10/01	Logistic Regression	6	U5 Lab+Prob due.
5	10/06, 10/08	Non-Linear Optimization	7	U6 Lab+Prob due.
6	*10/14*, 10/15	*Class Tuesday, not Monday* Midterm Review		U7 Lab+Prob due.
7	10/20, 10/22	**Midterm Exam**		
8	10/27, 10/29	Neural Networks	9	
9	11/03, 11/05	Convolutional Neural Networks	10	U9 Lab+Prob due.
10	11/10, 11/12	PCA	11	U10 Lab+Prob due.
11	11/17, 11/19	Word Embeddings and Tokenization	12	U11 Lab+Prob due.
12	11/24, –	*Wednesday is a Friday Schedule* slack-time	-	
13	12/01, 12/03	Attention and LLMs	12	U11 Lab+Prob due.
14	12/08, 12/10	Clustering and K-Means	13	U12 Lab+Prob due.
15	12/15, 12/17	**Final Exam**		U13 Lab+Prob due.