ECE 474 Machine Learning Syllabus Fall 2025 Course Description.

Machine learning of structural relationships among variables from empirical data. Decision theory, Bayesian methods. Classification: naive Bayes, linear discriminant analysis, support vector machines(SVM), boosting. Regression: least squares, regularization methods, logistic regression. Clustering using k-means and EM algorithms. Model selection: bias-variance tradeoff, cross-validation, over-fitting. Feature selection and dimensionality reduction methods including PCA, ICA, MDS. Kernel methods. Other topics may be covered as time permits.

Time: Thurs 2-5

Office Hours: Wed 4-5, Thurs 1-2. Mondays via Teams by appointment.

Pre-Requisites: MA 223, MA 224; either ECE 211, ChE 352 or ME 251.

Credits: 3

Textbook:
Christopher Bishop, *Pattern Recognition and Machine Learning*,
Reference Textbooks
Duda, Hart and Stork, *Pattern Classification*
http://www.columbia.edu/~jwp2128/Teaching/E6720/BayesianModelsMachineLearning2016.pdf
https://www.cs.toronto.edu/~radford/ftp/bayes-tut.pdf

Grading: There are 7 base projects, worth 10 points each. Complete all 7 projects perfectly and you get a C. There will be additional ways to earn points, such as reading papers, participating in paper discussions, and completing stretch goals on the projects. It works out like this:

7 projects, 10 points each = 70 total points
5 papers, 1 point for completing a paper evaluation, 1 point for in-class reflection question participating in discussion = 10 total points
Miscellaneous stretch goals = 25 additional available points.

AI-Generated Code

Unfortunately, coding exercises are easily plagiarized and generated with AI. It is normal and productive to share snippets of code with colleagues, or to find code on the internet to use, and even to use gen AI to write code. It is not acceptable to turn in code you do not understand. In industry, a common practice is code review, in which before your code gets accepted into a larger code base, you sit with another coder and explain what your code does and why. In this class, we will be experimenting with a new approach to code reviews. I will use generative AI to write a 5 question quiz ***specific*** to the code you turned in. If you work in a group, your group will all get the same quiz.

Please note all of this is in addition to the policies found here:

https://cooper.edu/engineering/curriculum/academic-standards-regulations

Submission Policies:

Each project must be submitted as a sharable google colab link, by 9am the day of the quiz.

There will be a google form for each assignment in which you will enter your group members and python file.

Unique quizzes will be generated and a quiz will be given at the start of class.

You will not be allowed to take a quiz if you have not submitted a working assignment. You must request an extension in advance.

If you wish to submit stretch goals later in the semester, this will be allowed, but a corresponding quiz will be generated.

Grading Rubric for Mini Projects:

5 points: Quiz
4 points: Technical accuracy of code (did you complete all requirements, etc.…)
1 point: Quality of code (well organized, well commented, well labeled plots, etc.…)

Grading breakdown:

100-90 points = A
89-80 points = B
79 - 70 points = C
69-60 points = D

Tentative Schedule:

9/4
9/11 Paper #1
9/18 Proj #1 Conjugate Priors
9/25 Paper #2
10/2 Project 2 Linear Regression
10/9 Paper #3
10/16 Project #3 Linear Classification
10/23
10/30 Project #4 Gaussian Processes
11/6 Paper #4
11/13 Project #5 Expectation Maximization
11/20 Paper #5
11/25 **Tuesday is a Thursday**
11/27 *Thanksgiving No Class*
12/4 Project #6
12/11 *Study Period No Class*
12/18 Project #7