

# Foundations of Machine Learning

## Fall 2018

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**Course Website:** Canvas & GitHub  
**Lecture:** Tuesdays 10:40-11:35am and Thursdays 10:40-12:20pm, NEB 100

**Course Description:** This course will cover introductory topics in pattern recognition and machine learning. We will review some needed mathematical and statistical concepts throughout the course. The following is an approximate schedule of the course:

- **Week 1-3, Aug. 23-Sept. 6: Introduction to Machine Learning Concepts:**
  - *What is Machine Learning?*
  - *Regression*
  - *Overfitting and Regularization*
  - *Maximum Likelihood and Maximum A-Priori*
- **Weeks 4-5, Sept. 11 - Sept. 18: Non-parametric Clustering and Classification Methods and Evaluation Metrics:**
  - *K-Means*
  - *K-Nearest Neighbors*
  - *Error and Accuracy Metrics*
  - *ROC Curves*
  - *Cross Validation*
- **Weeks 6-7, Sept. 20-Oct. 4: Parametric Clustering and Classification Methods :**
  - *Gaussian Mixture Models*
  - *Probabilistic Generative Models*
- **Weeks 7-8, Oct. 9 - Oct. 16: Dimensionality Reduction:**
  - *Curse of Dimensionality*
  - *Principal Components Analysis*
- **Weeks 9-11, Oct. 18 - Nov. 1: Linear Discriminants and Artificial Neural Networks:**
  - *Linear Classifiers*
  - *Artificial Neural Networks:* Neuron, Perceptron Learning Algorithm, Multi-layer Perceptrons, Back-Propogation
- **Weeks 11-13, Nov. 6 - Nov. 15: Introduction to Deep Learning:**

- Autoencoders
- Momentum + ADAM + Other Deep Learning Strategies

• **Weeks 13-15, Nov. 20-Dec. 5: Modeling and Optimization Strategies:**

- Genetic and Evolutionary Algorithms
- Coming up with and defining objective functions

**Required Textbook:** C. Bishop, “Pattern Recognition and Machine Learning,” Springer, 2006. ISBN 0387310738.

**Programming Language:** We will be using Python 3+ in this course for all class assignments that require code implementations.

**Prerequisites:** Programming ability; Prior exposure to calculus, probability, statistics and linear algebra.

**Evaluation and Grading:**

Mid-Term Exam	20% of grade
Projects (2 projects)	30% of grade
Homework Assignments (approx. 8 assignments)	50% of grade (+ assignment with lowest grade will be dropped)

*Grading Scale:*

A	$x \geq 93.5$
A-	$93.5 > x \geq 90.0$
B+	$90.0 > x \geq 86.7$
B	$86.7 > x \geq 83.5$
B-	$83.5 > x \geq 80.0$
C+	$80.0 > x \geq 76.7$
C	$76.7 > x \geq 73.5$
C-	$73.5 > x \geq 70.0$
D+	$70.0 > x \geq 66.7$
D	$66.7 > x \geq 63.5$
D-	$63.5 > x \geq 60.0$
E	$60.0 > x$

**Late Homework Assignments will not be accepted. Projects submitted late will lose 1 letter grade per day late.**<sup>1</sup> If you feel a graded assignment or exam needs to be re-graded, you must discuss this with the instructor within one week of grades being posted for that assignment/exam. After one week, items will not be considered for re-grading. The class will be graded on a curve.

**Assignment Requirements:** Requirements for all assignments in this class are listed below. For maximum credit, along with correct, substantial answers, I expect high quality professional looking code and documents. Complete your assignments with care and ensure that your submission illustrates that you understand the concepts the assignment is trying to emphasize.

- For all assignments that require submission of code, turn in clean, easy to read, easy to run, and well commented Python 3+ code. Points will be taken off if code cannot be run and/or easily understood. For example, do not use one letter variable names, do not include “magic” numbers/parameters in your code that are unexplained, etc.
- Complete all assignments in the format assigned. For example, if a PDF document is requested and a Word DOC is submitted instead, you will lose points.
- Most assignments will be assigned (and will need to be submitted) via GitHub. Be sure to pay attention and follow any required file naming conventions or file organization requirements for all assignments.

**Academic Dishonesty:** 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 (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-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.

**Any student found to have received or given unauthorized aid during on an exam or assignment will be given a grade of 0 for that exam or assignment and the evidence will be sent to the student honor court for the determination of any additional disciplinary action.** Unless an assignment

<sup>1</sup>For example, if you earned a B on your project and you submitted your project 24 hours and 1 minute after the due date, you will receive a D on the project because it is two days late.

is specifically structured as a group project, duplicate assignments written in collaboration with others is not acceptable. Although it is permissible to discuss the homework with others, these discussions should be of a general nature. All work at a detailed level must be done on your own. Students submitting the same or similar solutions to the homework will be considered as having cheated. No statements or actions made by anyone can alter this policy.

**Accommodations:** Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

**Online Course Evaluation:** Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.