



University of Houston Downtown Syllabus

CS 4319 Statistical and Machine Learning Summer III 2024

Credits: 3

Class Number: 17690

Instructor: Dr. Pablo Guillen-Rondon

Email: guillenrondonp@uhd.edu

CLASS MODE: Online asynchronous

OFFICE HOURS:

Office Location: S-717

Phone Number: 713-221-2781

Office Hours: by appointment

Course description: Machine learning is the science of developing statistical methods that quantify relationships within data. This branch of mathematics/computer science has seen an explosive growth over the past decade as our ability to store and process digital data has dramatically increased. Prediction, classification, regression, and identification are the aims of learning from data. All these problems are routinely performed in data analytics.

This course blends the predictive perspective of statistical pattern recognition and the algorithmic perspective of machine learning. Topics include but are not limited to applications of appropriate machine learning algorithms in various disciplines, prediction and performance metrics, data transformations, supervised and unsupervised learning, and ensemble methods.

This course will focus on a series of practical case studies. At the end of the course the students will be able to use Python to (1) load a data set from a file, (2) prepare the data for analysis, (3) build and tune an appropriate machine learning algorithm, (4) assess the future performance of the algorithm on new data, and (5) apply the algorithm on a new dataset to predict the outcome. The Python software used in the course will make use of software tools (modules and functions) and databases publicly available in the Scikit-Learning and Keras libraries.

Due effort of learning in accordance with the class mode is expected from all students.

Prerequisites: CS 4319 Prerequisite(s): A grade of C or better in CS 3304, or a grade of C or better in DATA 3402 and credit for or concurrent enrollment in STAT 4310.

Course Textbook

Required Text(s):

Machine Learning with R, 3rd Edition by Brett Lantz, Packt Publishing. ISBN-13: 9781788295864

A student of this institution is not under any obligation to purchase a textbook from a university affiliated bookstore. The same textbook may also be purchased from an independent retailer, including an online retailer.

Recommended (Optional) Readings:

Machine Learning in Python®: Essential Techniques for Predictive Analysis. Michael Bowles. Published by John Wiley & Sons, Inc. 2015

Building Machine Learning Systems with Python. Willi Richert and Luis Pedro Coelho. Published by Packt Publishing Ltd. 2013.

Deep Learning: <http://www.deeplearningbook.org/contents/TOC.html>

Notes and Papers published by the Instructor:

http://www.researchgate.net/profile/Pablo_Guillen3

Objectives

- To obtain an overview of the literature in statistics-learning and learning-based methods and applications.
- To obtain an understanding of a variety of machine learning techniques for classification, regression, and prediction.
- To obtain the ability to implement and experiment with a wide range of machine learning algorithms in Python with examples.
- To apply: Unsupervised and supervised learning and clustering concepts, Kernels, and kernel-based classifiers such as SVM, ensemble methods, and artificial neural network algorithms.
- To understand and implement learning-based methods for classification of images, signals, and features.

Content

- Introduction to data mining.
- Introduction to exploratory data analysis.
- Introduction to unsupervised and supervised learning: Concepts and Definitions.
- Clustering algorithms: K-means.
- Introduction to machine learning techniques: K-Nearest Neighbors, Decision Tree, Random Forest, Support Vector Machine, Neural Networks, Ensemble methods.
- Support vector machine and optimization of parameters: Linear, Polynomial and Gaussian Radial Kernels.
- Deep learning algorithms: Multilayer Perceptron.
- Examples with machine learning frameworks to predict data, signals, and Images from various application areas.

Grading policy: 2 midterm exams (40%), homework and programming assignments (30%), 2 projects (15%), and Final project (15%).

Evaluation Criteria

Course grades will be determined as the weighted point average (WPA) of the following items:

Item Number	Item Description	Weight
1	Midterm Exam 1	20%
2	Midterm Exam 2	20%
3	Programming assignments	30%
4	Final Exam	30%

Letter grades will be assigned per UHD's Policy.

90 =< WPA → A, 80 =< WPA < 90 → B, 70 =< WPA < 80 → C, 60 =< WPA < 70 → D, WPA < 60 → F

Note: While I will post your assignment grades in Canvas, final grades will be calculated solely on the basis of the weighting and values described on the syllabus. Final grades or point totals in Canvas may not be accurate and should not be taken as the official grade source unless confirmed by the instructor.

Course Policies

- **Methods of Communication with the Instructor**

Several communication methods will be used:

1. Email:

- a) The Canvas email will be the official UHD email communication system for this class.

If you have an immediate/urgent question, please email me at my UHD email which is: guillenrondonp@uhd.edu

- b) I will be checking both my UHD email accounts and will respond to your questions in less than 48 hours (excluding weekends and holidays).

2. Class Announcements:

- a) I will be using the Announcements feature in Canvas to communicate information to the entire class. Please check your Canvas email and Class Announcements, frequently.

3. Phone:

- a) You can call me or leave a voice message at 713-221-2781

- **Online Course Support:**

I will use the Canvas LMS (<https://canvas.uhd.edu/>) to provide you with online course material. As the semester progresses, various materials will be posted there, including lecture notes, labs, and course announcements.

- **Grading and Course Evaluation**

All coursework, including programming assignments (or labs), must be submitted by the deadline. No late submissions will be accepted.

Make-up exams will *only* be given in cases of documented emergencies. It is your responsibility to contact your instructor with documentation of your emergency at least 3 days before the exam date.

Students are required to behave in a courteous and ethical manner. Plagiarism, cheating, and other forms of academic dishonesty is strictly forbidden and can result in a failing grade in the course or a suspension from the academic program. Discussion of topics in the class including homework assignments is encouraged. However, copying of code or answers from other student or web sources is strictly forbidden.

UHD Common Course Syllabus Policies

<https://www.uhd.edu/academics/syllabus.aspx>

In addition to the policies specified in this course syllabus, all UHD courses also follow shared policies published on [our syllabus website](#) addressing the following areas:

- *Responses to University-Wide Disruptions*
- *Academic Honesty*
- *Accessibility and Statement of Reasonable Accommodations*
- *Attendance and Roster Certification*
- *Book Purchasing*
- *Recording of Class Sessions*
- *Religious Holy Days*
- *Safety Precautions*
- *Student Support Services*
- *Student Counseling Services*
- *Technology Requirements*
- *Testing and Final Exams*
- *Use of Blackboard, Canvas, Gatormail, and Zoom*

PREPARED BY

Hong Lin
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