USC Viterbi
School of Engineering
Information Technology Program

ITP-449: Applications of Machine Learning
Units: 4. Summer 2024

Tue, Thu 4:00 - 6:05 pm, GFS 207 & ONLINE

Important: Zoom recordings of the lectures will be provided for the summer session. You can attend lectures in-person or over Zoom.

Instructor: Sinan Seymen, Ph.D.
Office Hours: To posted on Blackboard
Contact Info: seymen@usc.edu

Learning Assistants: To be announced on Piazza.
LA Lab Sessions: To posted on Blackboard

IT Help:
USC IT (ITS): https://itservices.usc.edu/contact/
Viterbi IT: https://viterbi.usc.edu/resources/vit/contact-us.htm

Course Overview

From eerily accurate movie recommendations to the selection of inspection-worthy soil and rock samples on Mars, it is increasingly commonplace to discover machines using data to make critically important decisions. This course introduces the interdisciplinary field of machine learning which is at the intersection of computer science, statistics, and business. In this course, students will learn to use Python to acquire, parse and model data. A significant portion of the course will be a hands-on approach to the fundamental modeling techniques and machine learning algorithms that enable students to build robust predictive models of real-world data and test their validity.

Learning Objectives

This course seeks to:

- provide students a deeper understanding - conceptually and contextually - of both the modern machine learning landscape and the engineering problem solving process as a whole.
- prepare students for real-world application of skills related to machine learning models, including data wrangling, model training, and results analysis.

Measurable Outcomes

After completing this course, students will be able to:

- Perform exploratory data analysis.
- Transform raw data into the appropriate format for machine learning processing.
- Build and refine machine learning models.
- Use machine learning models to predict patterns from data.
- Communicate data-driven insight.

Prerequisite(s)

ITP-115 or ITP-116 or equivalent

Course Notes

Lecture slides and any supplemental course content will be posted to Blackboard. All announcements for the course will be posted to Blackboard. Information about assignments, due dates, exams and grades will also be posted on Blackboard. Students should check Blackboard regularly for updates.

Attendance and Etiquette

Attendance is not part of the grading breakdown, although attending scheduled meetings will help you learn the material and succeed in this class. The instructor expects you to pay attention during scheduled meetings and be an active learner. Chatting while the instructor is talking, texting on your mobile device, and participating on social media sites during class is disrespectful to the instructor and your classmates. If you are not able to attend lectures, then you should watch the recorded lectures and complete the in-class labs.

Adding the course after the first week

Per university policy, students are allowed to add the course until the end of week three. Any students wishing to add the course should plan on attending the course from the beginning of the semester. If the student needs to add the course after week 1, they will need to apply for D-Clearance. Upon getting D Clearance, students will need to reach out to advising to add the class, and should email the instructor immediately to make sure there is a plan for completion of work and learning missed materials. Any missed work is required to be completed and submitted according to the schedule provided by the instructor.

Technological Proficiency and Hardware/Software Required

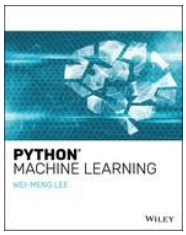
Students will need a computer (laptop or desktop) and access to the internet. If you do not have access to a computer, please contact your instructor.

Students should have basic technical knowledge of their computer, including the ability to install software, download course material, and properly submit their assignments online. All software needed for the course is available for free.

Required Readings and Supplementary Materials

Required materials: None

Supplementary Materials:



Wei-Meng Lee. *Python Machine Learning*. Wiley, 2019.
https://learning.oreilly.com/library/view/python-machine-learning/9781119545637/

Description and Assessment of Assignments

This course will make use of Blackboard for assignments. All assignments will be posted to Blackboard under the "Assignments" section. Each assignment will include instructions, a due date, and a link for electronic submission. Assignments must be submitted using this link.

Grading Breakdown

The weight of the graded material during the semester is listed below:

Item	% of Grade
Assignments	30
Final Project	20
Exam I	25
Exam II	25
Total	100

Piazza

The preferred way to communicate with the instructor and LAs is posting on Piazza (http://piazza.com). All the students, instructor, and LAs will have access to the same class on Piazza. Information about accessing Piazza is available on Blackboard. If you have questions about assignments, labs, tests, and other aspects about this course, please post on Piazza. You can make public posts which all members can see and answer or private posts which are only accessible to instructor and LAs.

Assignments

Assignment: week-long assignments which pertain to the material from the current week as well as to previous weeks. Typically, these are due one and a half weeks after being assigned.

Generally, each week there will be one assignment to complete; they will relate to the topic covered that particular week. **Unless otherwise noted, students must complete these assignments individually**. Each assignment will include instructions, a due date, and a link for electronic submission. Assignments must be submitted using this link; they will not be accepted through any other method.

Late Assignment Policy

It is the student's responsibility to submit assignments on or before the due date. Assignments may be submitted within two days with a late penalty. Assignments turned in one day (24 hours) late will have 25% of the total points deducted from the graded score. Assignments turned in over one day and up to two days (>24 hours and <= 48hours) late will

have 50% of the total points deducted from the graded score. After two days, submissions will not be accepted, and the score for the assignment will be a 0.

Regrade requests

Students have one week to contest a grade once it has been posted. After this one week, the grade will not be changed. To contest a grade, create a private post on Piazza and select the grades folder. In the post, include your name, the assignment name, and your reasons. Tag your instructor and your grader. This will allow the grader and instructor to view your submission and make a decision.

Exams

No make-up tests (except for documented medical or family emergencies) will be offered. If you will not be able to attend a test due to an athletic game or other valid reason, then you must coordinate with the instructor before the test is given. You may arrange to take the test before you leave with an approved university personnel during the time you are gone, or within the week the test is given. If you do not take a test, then you will receive a 0 for the test. If you need accommodations authorized by the Office of Student Accessibility (OSAS), notify the instructor at least two weeks before the test. This will allow time for arrangements to be made.

Final Project

There will be a final project in this course which aims to solve a real-world problem by applying Pythonic techniques.

The final project will be graded on how the student applies variety of techniques learned in this course to a given problem. It will be semi-structured, allowing students to apply creative approaches to a real-life problem at hand.

You might work with groups of 2 if you prefer, and each group will have consultation with me before their submission to go over their ideas and achievements.

Course Schedule: A Weekly Breakdown

Week	Topics	Supplementary Reading	Assigned work	Due
1	**Introduction** **Python Core 01**	Will be announced on Blackboard.		
2	**Python Core 02** • Review of Python fundamentals • Branching • Loops • Lists • Modules			
3	**Data Manipulation** • NumPy and Pandas • Data structures		Assignment 1	05/31/2024

	• Indexing • Selecting, combining, and removing data • Null and missing values			
4	**Data Manipulation Cont.** **Data Visualization** • Legends and annotations • Plotting functions		Assignment 2	06/07/2024
5	**Machine Learning Basics** • Machine learning process • Supervised and unsupervised learning • Algorithm overview • scikit-learn • Data representation • Data cleansing		Assignment 3	06/14/2024
6	**Exam 01**			
7	**ML: Linear Regression** • Simple linear regression • Multiple linear regression • Implementing Linear Regression • Model diagnostics and validation			
8	**ML: Logistic Regression** • Logistic regression theory • Implementing Logistic Regression • Computing accuracy, precision, recall		Assignment 4	07/12/2024
9	**ML: Clustering** • K-Means theory • Implementing K-Means • Finding optimal K • K-Means evaluation		Assignment 5	07/12/2024
10	**ML: K-Nearest Neighbors** • KNN theory • Implementing KNN • Visualizing KNN • Model validation		Assignment 6	07/19/2024
11	**ML: Trees and Random Forests** • Building decision trees and random forests • Decision tree and random forest analysis • Strengths and weaknesses		Assignment 7	07/26/2024
12	**FINAL PROJECT and EXAM 2**	**Date**: Will be announced on Blackboard.		

Academic Integrity

Assignments in computer programming courses are different from those in some other types of courses. Students may NOT collaborate, work together, share code, or in any way exchange solutions for assignments. Assignments may be analyzed by software that looks for similarity. Any sharing of ideas or code will be considered a violation of academic integrity (cheating); an SJACS report will be filed with the recommended penalty of an F in the course. Do not share your code with anyone else in this or a future section of the course, as allowing someone else to copy your code carries the same penalty as copying the code yourself.

If the instructor, a grader, or a teaching assistant suspects you of academic dishonesty, it has to be reported to SJACS. Do not share assignments with another person. Do not submit another person's work as your own. Do not look at other students' papers during tests. Do not leave the room during a test without permission. Do not cheat! As Trojans, we are faithful, scholarly, skillful, courageous, and ambitious.

Academic Conduct

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Sharing of course materials outside of the learning environment

As per SCampus Section 11.12(B):

Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study is a violation of the USC Student Conduct Code. This includes, but is not limited to, providing materials for distribution by services publishing class notes. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the Internet or via any other media. (See Section C.1 Class Notes Policy

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The

Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-1200 – 24/7 on call
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.