USC Viterbi School of Engineering *Information Technology Program*

ITP 449: Applications of Machine Learning

Units: 4. Spring 2025

Instructor: Reza Jafarkhani
Contact Info: jafarkha@usc.edu

Meeting Hours / Location:

Sec. 32028	TTh 4:00 - 5:50 pm (PT)	LVL 17
Sec. 32027	TTh 6:00 - 7:50 pm (PT)	LVL 17

Office Hours:

I. Piazza
II. TTh 2:30 pm – 3:30 pm (PT) RRB 211 (or Zoom)
III. By Appointment

Learning Assitant / Email / Office Hours:

Rohan Bhave	rbhave@usc.edu	TBD
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Nicholas Dorgan	ndorgan@usc.edu	TBD
Christopher Kuizon	ckuizon@usc.edu	TBD
Myles Molnar	mdmolnar@usc.edu	TBD
Jackie Pham	jtpham@usc.edu	TBD
Thomas Seli	seli@usc.edu	TBD

Course Description

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

After completing this course, students will be able to:

- Perform exploratory data analysis using Python
- Build and refine machine learning models to predict patterns from data
- Communicate data-driven insights

Course Notes

Lecture slides and any supplemental course content will be posted to Brightspace for use by all students. All announcements for the course will be posted to Brightspace/Piazza. Information about assignments, due dates, exams and grades will also be posted on Brightspace. Students should check Brightspace regularly for updates.

Technological Proficiency and Hardware/Software Required

Most assignments in the class are done using software. Software will be provisioned for download or available through a virtual lab. Students are expected to have access to a computer. ITP has a limited number of laptops that students can request to borrow.

Prerequisite(s): ITP 216

Textbook (free-of-charge)

Wei-Meng Lee. *Python Machine Learning*. Wiley, 2019.
This book is available through USC Libraries Safari Books: https://libraries.usc.edu/databases/safari-books

Description and Assessment of Assignments

This course will make use of Brightspace for assignments. All assignments will be posted to Brightspace 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.

Piazza

The preferred way to communicate with the instructor and CPs is posting on Piazza (http://piazza.com). All the students, instructor, and CPs will have access to the same class on Piazza. Information about accessing Piazza is available on Brightspace. 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 CPs.

Grading Breakdown

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

Item	% of Grade
Assignments	40
Final Project	15
Exam I	20
Exam II	25
Total	**100**

Grading Scale (sample)

This is a sample grading scale. Final scale will be determined by class average and score distribution.

A	95-100
A-	90-94
B+	87-89
B	83-86
B-	80-82
C+	77-79
C	73-76
C-	70-72
D+	67-69
D	63-66
D-	60-62
F	59 and below

Grading Timeline

Grading of homework will typically be done within 2 weeks of the deadline.

Policies

Students are expected to attend and participate in lecture discussions, in-class exercises. However, attendance is not mandatory and will not count towards your grade.

Students are responsible for completing individual assignments and their fair share of team assignments by stated deadlines. Late assignment submissions will be subject to a late penalty. Assignments turned in late will have 25% of the total points deducted from the graded score for each late day up to 3 days. No assignments will be accepted later than 72 hrs from the due date. You will have 3 “grace days” for the semester. i.e., no late penalty on HW for a cumulative 3 days. No grace days are available for Project.

Students have one week to contest a grade once it has been posted on Brightspace. 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.

No make-up exams (except for documented medical or family emergencies) will be offered. If they will not be able to attend an exam due to an athletic game or other valid reason, then they must coordinate with the instructor before the exam is given. They may arrange to take the exam before they leave, with an approved university personnel during the time they are gone, or within the week the exam is given. If students do not take an exam, then they will receive a 0 for the exam.

If students need accommodations authorized by OSAS (Office of Student Accessibility Services), notify the instructor at least two weeks before the exam. This will allow time for arrangements to be made.

Zoom synchronous sessions will be recorded and provided to all students asynchronously.

USC Technology Support Links

Zoom information for students
Software available to USC Campus

IT Help:

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

Sharing of course materials outside of the learning environment

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).

Statement on Academic Conduct and Support Systems

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.

Support Systems:

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

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298
equity.usc.edu, titleix.usc.edu
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
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity |Title IX for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services - (213) 740-0776
osas.usc.edu
Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101
diversity.usc.edu
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
dps.usc.edu, emergency.usc.edu
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) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Course Schedule

Date	Topics	Notes
Week 1	**Course Introduction** • Course objectives and outcomes • Tools and approaches • Machine Learning Lifecycle • Descriptive and predictive data models • Supervised versus unsupervised learning • Development Environment	
Week 2	**Review Python Packages** • NumPy, Pandas • Matplotlib and Seaborn scikit-learn	
Week 3	**Time Series** • Rolling means • Time series plotting • Smoothing techniques	
Week 4	**Machine Learning Basics** • Machine learning process • Supervised and unsupervised learning • Algorithm overview • scikit-learn • Data representation • Data cleansing	
Week 5	**Linear Regression** • Linear regression theory • Simple linear regression • Multiple linear regression • Implementing Linear Regression • Model diagnostics and validation	
Week 6	**Logistic Regression** • Logistic regression theory • Implementing Logistic Regression • Computing accuracy, precision, recall	
Week 7	**Naïve Bayes** • Bayes' Theorem (conditional probability) • Probabilistic model • Relation to logistic regression	

Week 8	**K-Means Clustering** • K-Means theory • Implementing K-Means • Finding optimal K • K-Means evaluation	
Week 9	**Exam I** (Tentative date: Thursday March 13)	
Week 10	**Spring Recess**	
Week 11	**K-Nearest Neighbors** • KNN theory • Implementing KNN • Visualizing KNN • Model validation	
Week 12	**Trees and Random Forests** • Building decision trees and random forests • Decision tree and random forest analysis Strengths and weaknesses	
Week 13	**Support Vector Machines** • SVM theory • Implementing SVM • Making predictions Kernels Plotting	
Week 14	**Neural Networks** • Perceptron • Neural Network • Activation functions	
Week 15	**Deep Neural Network** • MNIST dataset • Digit classification example	
	Exam II Thursday, May 8 **Sec. 32028** 4:30 pm - 6:30 pm (PT) **Sec. 32027** 7:00 pm - 9:00 pm (PT)	