



ITP 449: Applications of Machine Learning

Units: 4. Spring 2022

Instructor: Reza Jafarkhani

Meeting Hours / Location:

Sec. 32028R Tu/Th 4:00 pm - 5:50 pm (PT) CPA 150
Sec. 31827R Tu/Th 6:00 pm - 7:50 pm (PT) KDC 240

Office Hours:

Online: Piazza
In-person: Tu/Th 8:00 pm - 8:30 pm (PT) KDC 240

Contact Info: jafarkha@usc.edu

Course Producer / Email / Office Hours:

Timothy Carpenter-Frank	carpentt@usc.edu	TBD
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Hongyu (Fiona) Yin	hongyuyi@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 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.

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 115 and ITP 249

Course Notes

Lecture slides and any supplemental course content will be posted to Blackboard for use by all students. All announcements for the course will be posted to Blackboard.

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 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.

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 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 CPs.

USC Technology Support Links

[Zoom information for students](#)

[Blackboard help 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>

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

Policies

Students are expected to attend and participate in lecture discussions, in-class exercises and team meetings.

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 (24 hrs. grace period with 25% reduction). No assignments will be accepted later than 24 hrs. from the due date. Students have one week to contest a grade once it has been posted on Blackboard. 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 DSP (Disability Services and Programs), 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.

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

	Topics	Notes
Week 1 January 10	Course Introduction <ul style="list-style-type: none"> • Course objectives and outcomes • Tools and approaches • Machine Learning Lifecycle • Descriptive and predictive data models • Supervised versus unsupervised learning • Development Environment 	<u>Remote Only</u>
Week 2 January 17	Python Foundations <ul style="list-style-type: none"> • Review of Python fundamentals • Branching • Loops • Lists • Modules 	
Week 3 January 24	Relevant Python Packages <ul style="list-style-type: none"> • NumPy • Pandas • Matplotlib and Seaborn • scikit-learn 	
Week 4 January 31	Exploratory Data Analysis Basics <ul style="list-style-type: none"> • NumPy and Pandas • Data structures • Indexing • Selecting, combining, and removing data • Null and missing values 	
Week 5 February 7	Data Visualization <ul style="list-style-type: none"> • Plot types • Legends and annotations • Plotting functions 	
Week 6 February 14	Time Series <ul style="list-style-type: none"> • Rolling means • Time series plotting • Smoothing techniques 	
Week 7 February 21	Machine Learning Basics <ul style="list-style-type: none"> • Machine learning process • Supervised and unsupervised learning • Algorithm overview • scikit-learn • Data representation • Data cleansing 	

Week 8 February 28	Linear Regression <ul style="list-style-type: none"> • Linear regression theory • Simple linear regression • Multiple linear regression • Implementing Linear Regression • Model diagnostics and validation 	<u>Exam I</u> (Tentative date)
Week 9 March 7	Logistic Regression <ul style="list-style-type: none"> • Logistic regression theory • Implementing Logistic Regression • Computing accuracy, precision, recall 	
Week 10 March 14	Spring Recess	
Week 10 March 21	K-Means Clustering <ul style="list-style-type: none"> • K-Means theory • Implementing K-Means • Finding optimal K • K-Means evaluation 	
Week 11 March 28	K-Nearest Neighbors <ul style="list-style-type: none"> • KNN theory • Implementing KNN • Visualizing KNN • Model validation 	
Week 12 April 4	Trees and Random Forests <ul style="list-style-type: none"> • Building decision trees and random forests • Decision tree and random forest analysis • Strengths and weaknesses 	
Week 13 April 11	Support Vector Machines <ul style="list-style-type: none"> • SVM theory • Implementing SVM • Making predictions • Kernels • Plotting 	
Week 14 April 18	Working with API Data <ul style="list-style-type: none"> • Access public APIs • Read and write data in JSON 	
Week 15 April 25	Final Project due	
Exam Week	Thursday May 5 Sec. 32028R: 4:30 pm – 6:30 pm (PT) Sec. 31827R: 7:00 pm – 9:00 pm (PT)	<u>Exam II</u>