ITP 449: Applications of Machine Learning
Units: 4. Fall 2020

Instructor: Reza Jafarkhani
Meeting Hours: MW 2:00 - 3:50 pm
Office Hours: MW 3:50 - 4:30 pm
Contact Info: jafarkha@usc.edu

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

Teaching Assistants / Email / Office Hours:

Adnan Ansari: azansari@usc.edu   Th 9:00 am-11:00 am (PDT)

Akshay Gulati: gulatiak@usc.edu   Fri 1:00 pm-3:00 pm (PDT)

Chinmayee Siddaramaiah: siddaram@usc.edu   Tu 9:00 am-11:00 am (PDT)

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.

USC Technology Support Links

Zoom information for students
Blackboard help for students
Software available to USC Campus

Grading Breakdown

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

Item	% of Grade
Assignments	30
Final Project	10
Exam I	30
Exam II	30
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. Assignments turned in late will have 25% of the total points deducted from the graded score for each late day.

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).

Course Schedule

	Topics	Assignments will be posted on Blackboard
Week 1 August 17	**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 August 24	**Python Foundations** • Review of Python fundamentals • Branching • Loops • Lists • Modules	
Week 3 August 31	**Relevant Python Packages** • NumPy • Pandas • Matplotlib and Seaborn • scikit-learn **Exploratory Data Analysis Basics** • NumPy and Pandas • Data structures • Indexing • Selecting, combining, and removing data • Null and missing values	

Week 4 September 7	**Data Visualization** • Plot types • Legends and annotations • Plotting functions	
Week 5 September 14	**Time Series** • Rolling means • Time series plotting • Smoothing techniques	
Week 6 September 21	**Machine Learning Basics** • Machine learning process • Supervised and unsupervised learning • Algorithm overview • scikit-learn • Data representation • Data cleansing	
Week 7 September 28	**Linear Regression** • Linear regression theory • Simple linear regression • Multiple linear regression • Implementing Linear Regression • Model diagnostics and validation **EXAM I**	
Week 8 October 5	**Logistic Regression** • Logistic regression theory • Implementing Logistic Regression • Computing accuracy, precision, recall	
Week 9 October 12	**K-Means Clustering** • K-Means theory • Implementing K-Means • Finding optimal K • K-Means evaluation	
Week 10 October 19	**K-Nearest Neighbors** • KNN theory • Implementing KNN • Visualizing KNN • Model validation	
Week 11 October 26	**Trees and Random Forests** • Building decision trees and random forests • Decision tree and random forest analysis • Strengths and weaknesses	
Week 12 November 2	**Support Vector Machines** • SVM theory	

	• Implementing SVM • Making predictions • Kernels • Plotting	
Week 13 November 9	**Working with API Data** • Access public APIs • Read and write data in JSON **EXAM II**	
Week 14	**Final Project due**	

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 Disability Services and Programs - (213) 740-0776
dsp.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.