

Berkeley Extension

Summer 2023

COMPSCI X433.6 - Section 021, Introduction to Machine Learning Using Python
2 semester units (30 instructional hours)

BASIC COURSE INFORMATION

Course Meeting Dates & Times:

Thursdays, 6:00-9:00 pm, PST
June 15 – August 17, 2023

Course Format:

Live-Online
Zoom link: Will be emailed

Live Online courses provide an interactive learning experience with scheduled synchronous online sessions held via Zoom video conferencing (Pacific Time). As with courses held in person, the teaching methods for Live Online courses emphasize lectures, demonstrations, group discussions and collaborative activities. Students should be prepared to attend every session and engage in class via webcam.

Instructor: Sridevi Pudipeddi, Ph.D.

E-mail: sridevip@berkeley.edu

Instructor Availability:

Available by email (checked frequently and best point of contact)

Course Online Resources (CANVAS):

<https://onlinelearning.berkeley.edu/>

Technical Requirements and Access to Online Resources:

Please check your computer technical specifications. This course uses the Learning Management system (LMS) called CANVAS. In order to use Canvas, your computer will need to meet these technical specifications. Additionally, instructors will use the Zoom web conferencing tool to live-stream their classes. Please also check your computer technical specification to use Zoom and ensure that you have a stable Internet connection. Please review our [online classroom orientation resource](#) to learn about how to access and use CANVAS.

Important Deadlines:

Drop: Must be done before the start of the second class meeting.

Withdraw or Grade Option Change: Must be submitted before the last class meeting. You can add, drop, or withdraw by logging into your student portal.

COURSE OVERVIEW

Course Prerequisites:**Required**

- Knowledge of statistics as covered in a first semester undergraduate course. Need to fulfill this prerequisite? Take a course: [Introduction to Statistics](#) STAT X10
- [Programming in Python](#). Need to fulfill this prerequisite? Take a course: [Programming Python](#) COMPSCI X434
- A moderate level of programming ability in a high-level language. Must have written programs involving most of the following: Variables, arrays, accessing elements, arithmetic, logic, branching, looping, strings, input/output, functions, scoping and visualization.
- Basic exposure to probability and statistics
- Personal laptop for running assignments and in-class activities and quizzes

Course Description:

Learn why the open-source programming language Python has been extensively adopted by the machine-learning community and industry. Python allows its users to create products that parse, reduce, simplify and categorize data, and then extract actionable intelligence from that data. In this course, you'll use Python to understand machine-learning concepts, terms and methodology, and then build applications to gain an intuitive understanding of the mathematics underlying the program. Example real-world applications include search engines, image analysis, bioinformatics, industrial automation, speech recognition and more.

Learning Objectives:

Upon completion of this course, students will be able to:

This is an introductory course that covers concepts of Machine Learning and Data Mining — supervised and unsupervised classification.

The course will teach the students to:

- Identify and formulate machine learning problems
- Understand and implement algorithms in Python to solve simple machine learning problems
- Analyze the performance of a given or implemented machine learning solutions on practical datasets.

Methods of Instruction:

- Scheduled synchronous online lectures held via Zoom video conferencing
- Interactive in-class activities
- Supplemental videos
- Required reading from blogs and another references
- Required homework assignments
- Discussion
- Quizzes
- Presentations
- Final Project

COURSE MATERIALS

Required Textbooks:

None

Recommended Textbooks:

Textbook Title: Python for Machine Learning

ISBN: ISBN-13: 978-1789955750, ISBN-10: 178995575

Publisher: Packt

Authors: Sebastian Raschka and Vahid Mirjalili

Edition: 3rd

Textbook Title: Hands-On Machine Learning with Scikit-Learn and TensorFlow

ISBN: ISBN-13: 978-1491962299 ISBN-10: 1491962291

Publisher: O'Reilly

Author: Aurelien Geron

Edition: 2nd

Textbook Title: Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython

ISBN: 2nd Edition ISBN-13: 978-1491957660 ISBN-10: 1491957662

Publisher: O'Reilly

Author: Wes McKinney

Edition: 3rd

Textbook Title: Essential Python

ISBN: ISBN-13: 978-0960060900, ISBN-10: 0960060901

Publisher: Essential Education

Authors: Sridevi Pudipeddi and Ravi Chityala

Edition: 1st

CREDIT REQUIREMENTS

Course Assignments:

- Reading assignments:
 - o The student is expected to read the material that will be discussed in each session ahead of time to familiarize themselves with the material.
- Homework Assignments:
 - o There will be 3 homework assignments and students will have a week to turn in their work.
- Quizzes:
- For students who opt for a letter grade or Pass/No Pass option, the final exam must be taken in order to complete the course.
- There will be 2 quizzes during this course that will all take place during the sessions as documented in the course schedule (see below).
 - o Quiz will be proctored via Zoom, a webcam is required.
- The quiz will cover the chapters of the textbook as documented in the course schedule (see below).
- Each quiz can consist of multiple choice and essay type questions.
- Quizzes will be administered online through Canvas.
- Students are expected to complete the assessments independently of each other and without the use of online search engines or other resources. These are closed book.
- o Students of UC Berkeley Extension are expected to act with integrity, civility, and honesty, including but not limited to being honest in representations of themselves and their academic work and abiding by all of the rules and procedures set forth in the UC Berkeley Extension Code of Student Conduct

Final Project Requirements:

You are expected to work on an original idea that is substantial. You can solve any machine learning problem of your choice. If you want to experiment, you can also solve any deep learning problem. If you would like to discuss the details of your project with me, feel free to talk to me before or after class.

You can form teams of up to a maximum of 3 people to work on the project. Only one person in the group needs to upload the group's work. All members will receive the same grade. **There will be NO extension of this deadline.**

You need to prepare a report in pdf format that will explain the work that you have done including any relevant screen-shot and Python program(s) that you have written. Please see the section "Project report details" (see below) for more information.

You will be evaluated based on the following:

- Data preparation
- Data visualization
- Appropriate choice of architecture

Apart from the above-mentioned requirements, the grade will be dependent on the quality of the project, code and the report.

Project report details:

- Introduction – In this section, you should describe the problem that you are solving, any background information that will help the instructors to understand the program.
- Requirements - List all the Python modules that need to be installed. If some of these modules need a specific version, please indicate so. You can also list any other conditions that are needed to run the program.
- Description of the Python program. You need to describe the programs that you wrote.
- Screenshots of the program output - If you are using a specific hardware and cannot obtain a screenshot, please enclose appropriate photographs.
- Conclusion - Describe in brief the problem you solved, the program you wrote and obtained output.
- Python program - If the program is one file, please add it as one of the pages in the report. If the code is large and spans more than one file, enclose a separate zip file.
- If you are using a Jupyter notebook, make sure to add the above steps in Markdown cells and the code cells. You add the link from where you obtained the data.

On other hand, if you have the code in a py file, then write a supporting word document or a PDF explaining the above steps. You add the link from where you obtained the data. Have the py file and the word document or PDF in a folder and zip the folder and upload it.

Apart from the above-mentioned requirements, the grade will be dependent on the quality of the project, code and the report.

Class Participation and Attendance:

Please note that good attendance is a prerequisite to meeting classroom discussion and participation expectations.

- It is the student's responsibility to check Canvas and obtain class notes from other classmates in the event of an excused absence.
- Students are expected to keep their camera on during class meetings.
- In-class activities may include group discussions, breakout rooms, written reflection and assessment activities, and applying learning to cases in-class. Because shared learning and discussion is a large component of this course, there is no "make-up" for activities missed in class.

- **Lectures are intended to complement, rather than repeat course readings.** Therefore it is the students responsibility to keep up with the reading during the course in order to engage in valuable discussion and critical thinking in class.

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|---|---|
| Exemplary (90-100%) | <ul style="list-style-type: none"> ● Participates regularly and actively and contributes in ways that help build community ● Uses specific examples to support response and invite further discussion ● Contributions are relevant and demonstrate a thorough understanding and reflection regarding the question or concept being presented |
| Accomplished (80-90%) | <ul style="list-style-type: none"> ● Participates regularly and actively ● Uses specific examples to support response ● Contributions are relevant and demonstrate a thorough understanding regarding the question or concept being presented |
| Competent (70-80%) | <ul style="list-style-type: none"> ● Participates regularly but not as active in contributing ● Communicates ideas, opinions and conclusions clearly and completely ● Uses specific examples to support response |
| Developing (60-70%) | <ul style="list-style-type: none"> ● Does not participate regularly or actively contribute ● Communicates ideas but fails to provide examples to support response ● Contribution does not demonstrate an understanding of the question or concept being presented |
| Does not participate (<60%) | <ul style="list-style-type: none"> ● Indifferent or hinders the discussion |

Grade Breakdown and Weighting by Category:

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|-------------------------------|-------------|
| Discussions and Participation | 5% |
| Homework 1 | 10% |
| Homework 2 | 10% |
| Homework 3 | 10% |
| Quiz 1 | 20% |
| Quiz 2 | 20% |
| Final Project | 25% |
| Total | 100% |

Grading Options & Deadlines for Choosing Grading Options (required):

- CLG—credit letter grade (DEFAULT STUDENT GRADING OPTION)
- P/NP—pass/not pass
- NC—not for credit
- W—withdrawal (must be student-initiated)

| GRADE (FOR ROSTER) | PERCENTAGE BREAKDOWN | DESCRIPTION |
|--------------------------|------------------------------|--|
| A+ A A- | 93–100% 93–100% 90–92% | Excellent: The grade of "A+", when awarded at the instructor's discretion, represents extraordinary achievement, but does not receive grade point credit beyond that received for the grade of A. |
| B+ B B- | 86–89% 83–85% 80–82% | Good |
| C+ C C- | 76–79% 73–75% 70–72% | Fair: Each course in a certificate program must be completed with a grade of C or better, although some programs have higher requirements. |
| D+ D D- | 66–69% 63–65% 60–62% | Barely passed |
| F | < 60% | Failed |
| P | | Passed at a minimum level of C-minus or 70% |
| NP | | Not Passed—anything below a C-minus or below 70% |
| NC | | Not for Credit: Assigned to students who choose not to fulfill credit requirements |
| W | | Withdrawal: Withdrawal from a course without academic penalty. Issued based on a student-initiated withdrawal. See Alternative Grading Options, Incompletes and Withdrawals for more information |

Petition for Grade Option Change:

[Grading Basis Change Request Form](#) (the link to this form can also be found on the Extension website, under Student Services).

If you opt to change your grade option, you must inform your instructor as follows. The default for all students is to receive a letter grade. If you opt to change your grade option to a pass/no pass basis (P/NP) or a noncredit basis (NC), you must complete and submit the form above before the last class meeting. Extension will not accept any late grade option change form and cannot change a P/NP grade or NC grade option to a letter grade after recording it.

- **Passed and Not Passed (P/NP):** Passed/Not Passed can only be assigned to students who complete the requirements for credit. The student must have earned at least a "C-" to receive a Passed (P) grade.
- **Not for Credit (NC):** Not for Credit is assigned to students who choose not to fulfill credit requirements.

Petition to Withdraw:

You can submit a request to withdraw by logging into your student account and submitting the request on your enrollment history page before the last course meeting.

Withdrawal after the drop deadlines are non-refundable at the time and a "W" will appear on your student record.

Petition for Incomplete:

Incomplete grades may be assigned by an instructor on an exceptional basis if your coursework has been of passing quality but not finished during the term or enrollment period due to extraordinary circumstances beyond your control. The following criteria must be met:

- You have successfully completed 75 percent of the assignments, assessments or projects before requesting an Incomplete.
- You and the instructor have made a written agreement on the work required to complete the course and the due date by which you will submit the work to the instructor. The due date must be within three months of the course end date. If you do not complete the agreed-upon work, your instructor can submit a failing grade for you.
- You must submit the [Petition for "Incomplete" Grade form](#) prior to the course end date (the link to this form can also be found on the Extension website, under Student Services).

However, even if these criteria are met, it is at the discretion of the instructor whether to grant the Incomplete.

It may take your instructor several days to thoughtfully consider your Incomplete request. Communicate with your instructor as soon as you are aware of any circumstances that may prevent you from completing your course, even if you are not yet ready to submit an Incomplete request.

Other Grade Policies:

GENERAL POLICIES

Classroom Decorum:

- Please mute your microphone during lecture
- During lectures, if you have a question, please use the chat or raise your hand function on Zoom • Keep your camera on during class meetings
- Please turn off cell phones
- During lectures, please do not talk unless you have a question or comment relevant to the course material
- During discussions, please listen to others, do not interrupt
- Treat your instructor and classmates with respect

Classroom Visitors:

Auditing is not permitted in UC Berkeley Extension courses. You must formally enroll in the course and pay all fees before the second class meeting.

Student Disability Services:

UC Berkeley Extension provides equal access and opportunities to all of our offerings for persons with disabilities and special needs through our Disability Support Services (DSS) office. To ensure access to our courses and programs, DSS facilitates collaboration between Extension students, instructors, academic departments, and the campus community, including the UC Berkeley Disabled Students' Program, which determines the eligibility of accommodations for all UC Berkeley Extension students.

For support or inquiries, please contact DSS at extension-dss@berkeley.edu or (510) 643-5732 as soon as possible so that we can provide guidance to our resources and so that we can arrange any required support services for you in a timely manner.

Academic Integrity and Student Conduct:

Academic misconduct is any action or attempted action that may result in creating an unfair academic advantage for you or any other members of the academic community. This misconduct includes a wide variety of behaviors such as cheating, plagiarism, altering academic documents or transcripts, gaining access to materials before they are intended to be available, and helping another student to gain an unfair academic advantage.

As a student of UC Berkeley Extension, you are encouraged to reach out to your fellow students in your class to avoid isolation, to discuss materials, and to ask each other questions, but there are limits to this collaboration. Please review the following document on academic integrity

(http://extension.berkeley.edu/upload/academic_integrity.pdf), which clearly defines what constitutes cheating, as well as plagiarism and other forms of academic misconduct. Students are also responsible for informing themselves about UC Berkeley Extension's Code of Student Conduct and its grounds for discipline (<http://extension.berkeley.edu/upload/studentconduct.pdf>).

UC Berkeley Extension takes academic misconduct very seriously. Depending upon the nature of the incident, the academic disciplinary sanction may vary but can result in consequences such as a failing grade for the course or even suspension and dismissal.

Reasonable Accommodation for Students' Religious Beliefs, Observations and Practices:

In compliance with Education code, Section 92640(a), it is the official policy of the University of California at Berkeley to permit any student to undergo a test or examination, without penalty, at a time when that activity would not violate the student's religious creed, unless administering the examination at an alternative time would impose an undue hardship which could not reasonably have been avoided. Please contact the Extension program office for more information.

Other Extension Policies:

Including Privacy, Nondiscrimination, Sexual Harassment, Safety and Security, Classroom Recording: <http://extension.berkeley.edu/static/studentservices/student-guidelines/>

TECHNOLOGICAL SUPPORT

- Zoom: All participants are required to sign into a Zoom account prior to joining meetings hosted by UC Berkeley. Students can log in with an existing account or can create a free Zoom Account via the following link: <https://zoom.us/signup>.
 - For support with Zoom issues, contact the Zoom support line
- Canvas: For support with a Canvas issue, click the Help link at the bottom of Global Navigation menu on the left side of the Canvas screen

SCHEDULE

Below is a tentative schedule of what this class will aim to cover in each session.

| Session/ Week | Topics | Book Chapters/Reading | Assignments due |
|------------------|--------|--------------------------|--------------------|
|------------------|--------|--------------------------|--------------------|

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|--------|---|---------------------------|--|
| 1 DATE | <p>Quick overview of Anaconda distribution and Jupyter notebook</p> <p>Pandas -part 1</p> | Go over next week's notes | Practice how to use Jupyter notebook and review notes. make sure to complete inclass activities. |
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| 2 | <p>Pandas part 2</p> <p>Quick overview of differential equations</p> <p>Basics of Machine Learning</p> <p>Categorical variables</p> <p>Feature Scaling</p> | Go over next week's notes | Review notebook and check the provided references. |
| 3 | <p>Setting Pipeline</p> <p>Linear Regression - part 1</p> | Go over next week's notes | <p>Homework 1 will be assigned</p> <p>Review notebook and check the provided references.</p> |
| 4 | <p>Linear Regression - part 2</p> <p>Regularization</p> | Go over next week's notes | <p>Homework 1 is due</p> <p>Review notebook and check the provided references.</p> |

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|---|---------------------------------------|---------------------------|---|
| 5 | Logistic Regression | Go over next week's notes | Quiz 1 Review notebook and check the provided references. |
| 6 | Decision Tree and Random Forest | Go over next week's notes | Homework 2 will be assigned Review notebook |
| | | | and check the provided references. |
| 7 | Probability review Naive Bayes | Go over next week's notes | Homework 2 is due Review notebook and check the provided references. |
| 8 | KNN K-Means | Go over next week's notes | Homework 3 will be assigned Review notebook and check the provided references. |

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| 9 | SVM Bagging and Boosting Workings of AdaBoost | Work on final project | Homework 3 is due Review notebook and check the provided references. |
| 10 | Final project presentation | | Quiz 2 Final Project submission |

RIGHTS

Civility and Respect in an Atmosphere of Academic Freedom:

<http://students.berkeley.edu/uga/respect.stm>

UC Berkeley Extension Code of Student Conduct:

<https://extension.berkeley.edu/upload/studentconduct.pdf>

Course Copyright and Classroom Recording Policies:

<http://extension.berkeley.edu/static/studentservices/student-guidelines/> **DISCLAIMER**

The syllabus and schedule is subject to change.