

EE 518¹

Machine Learning Theory & Algorithms

Instructor Information:

Instructor: John Lipor

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Office: FAB 160-19

Office Hours: Wednesday 1:30-2:30PM (in person), Thursday 3:00-4:00PM (Zoom only)

Course Website: <http://web.cecs.pdx.edu/~lipor/courses/518/>

Secondary Website: <http://gradescope.com>

Course Time and Location: Monday, Wednesday 11:30 AM - 1:20 PM, Eng. Building 102

Course Description: The goal of this course is to provide a thorough understanding of the fundamental methodologies and algorithms used in machine learning. Students will learn to understand, implement, and innovate on algorithms for common tasks such as classification, regression, clustering, and dimensionality reduction. Topics covered include linear and nonlinear regression, bias-variance tradeoff, ensemble methods, support vector machines, K-means, hierarchical clustering, and Gaussian mixture models.

Prerequisite(s): Students should have a firm understanding of linear algebra and probability, at the level of EE 516: Mathematical Foundations of Machine Learning and EE 520: Random Processes, respectively. Students should also be comfortable with programming in Python.

Credit Hours: 4

Required Text: The course utilizes the free textbooks *Understanding Machine Learning* by Shalev-Shwartz and *The Elements of Statistical Learning* by Hastie, Tibshirani, and Friedman.

Course Objectives:

- Understand the tradeoffs between various approaches to supervised learning
- Gain a basic understanding of the statistical learning setup and how algorithm performance is analyzed
- Apply model selection techniques to tune algorithm parameters
- Implement algorithms from machine learning journal and conference papers
- Discuss and summarize relevant publications in the field with peers
- Prepare students for research in machine learning

¹Template for this syllabus courtesy of Brian R. Hall, <http://www.brianrhall.net/rss/latexsyllabustemplate>.

Grade Distribution:

Assignments	60%
Mini Projects	40%

Grading Policy: Final grade cutoffs will be 90/80/70% or lower.

Assignments:

- There will be a homework or mini project assigned most weeks. The problems will be posted each Friday to the course website and due the following Friday by 11:59 PM PT.
- Late homework assignments will not be accepted. Instead, the lowest homework score will be dropped. Late mini projects will receive zero credit.
- Assignments will be submitted via Gradescope. Correct registration is required in order to earn homework points. Create an account on <https://gradescope.com>, use course entry code **3P8WE6**. Register with your PDX email, student ID, and use your given name and family name.
- Follow the instructions for scanning and submitting homework here.
- **Extra credit** will be given for homework typeset using L^AT_EX. The value of this credit is such that if all assignments are typed, students may earn up to 10% extra credit on the overall homework score (max score 110%).
- Assignments are to be completed on your own. You are allowed to consult with other students (and instructors) during the conceptualization of a solution, but all written work, whether in scrap or final form, is to be generated by you, working alone. Also, you are not allowed to use, or in any way derive advantage from, the existence of solutions prepared in prior years. Violation of this policy is an honor code violation. If you have questions about this policy, please contact me. While collaboration can sometimes be helpful to learning, if overused, it can inhibit the development of your problem solving skills.
- Students may not consult online answer forums such as StackExchange or use existing problem solutions found online.
- For coding problems, students are encouraged to help one another debug, but each student must write their own code. Copied code will receive a zero grade.
- Further instructions for specific problems and mini projects will be provided on the course website or in the corresponding documents. Be sure to read these carefully.

Student Conduct: Students must abide by the Portland State University Code of Student Conduct, found at <https://www.pdx.edu/dos/codeofconduct>. Violations of this code will be handled according to procedure.

Access & Inclusion for Students with Disabilities: PSU values diversity and inclusion; we are committed to fostering mutual respect and full participation for all students. My goal is to create a learning environment that is equitable, useable, inclusive, and welcoming. If any aspects of instruction or course design result in barriers to your inclusion or learning, please notify me. The Disability Resource Center (DRC) provides reasonable accommodations for students who encounter barriers in the learning environment.

If you have, or think you may have, a disability that may affect your work in this class and feel you need accommodations, contact the Disability Resource Center to schedule an appointment and initiate a conversation about reasonable accommodations. The DRC is located in 116 Smith Memorial Student Union, 503-725-4150, drc@pdx.edu, <https://www.pdx.edu/drc>.

- If you already have accommodations, please contact me to make sure that I have received a faculty notification letter and discuss your accommodations.
- Students who need accommodations for tests and quizzes are expected to schedule their tests to overlap with the time the class is taking the test.
- For information about emergency preparedness, please go to the Fire and Life Safety webpage (<https://www.pdx.edu/environmental-health-safety/fire-and-life-safety>) for information.

Title IX Reporting Obligations: As an instructor, one of my responsibilities is to help create a safe learning environment for my students and for the campus as a whole. Please be aware that as a faculty member, I have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination. If you would rather share information about sexual harassment, sexual violence or discrimination to a confidential employee who does not have this reporting responsibility, you can find a list of those individuals. For more information about Title IX please complete the required student module Creating a Safe Campus in your D2L.

Class Recordings: We will use technology for virtual meetings and recordings in this course. Our use of such technology is governed by FERPA, the Acceptable Use Policy and PSU's Student Code of Conduct. A record of all meetings and recordings is kept and stored by PSU, in accordance with the Acceptable Use Policy and FERPA. Your instructor will not share recordings of your class activities outside of course participants, which include your fellow students, TAs/GAs/Mentors, and any guest faculty or community based learning partners that we may engage with. You may not share recordings outside of this course. Doing so may result in disciplinary action.

Classroom Requirements for All Students and Faculty Due to Covid-19: The University has established rules and policies to make the return to the classroom as safe as possible. It is required for everyone to follow all the Return to Campus rules and policies. To participate in this class, PSU requires all students to comply with the following.

Vaccination: Be vaccinated against COVID-19 and complete the COVID-19 vaccination attestation form. Those students with medical or nonmedical exemptions or who will not be on campus at all must complete the process described on the “COVID-19 Vaccine Exemption Request Form” to establish those exemptions.

Health Check, Illness, Exposure, or Positive Test for COVID-19: Complete the required self-check for COVID-19 symptoms before coming to campus each day. If you are feeling sick or have been exposed to COVID-19, do not come to campus. Call The Center for Student Health and Counseling (SHAC) to discuss your symptoms and situation at 503-725-2800. They will advise you on testing, quarantine, and when you can return to campus. If you test positive for COVID, report your result to SHAC and do not come to campus. SHAC will advise you on quarantine, notification of close contacts, and when you can return to campus. Please notify me (i.e. your instructor), should you need to miss a class period for any of these reasons so that we can discuss strategies to support your learning during this time. If I become ill or need to quarantine during the term, either I or the department chair will notify you via PSU email about my absence and how course instruction will continue.

Failure to Comply with Any of these Rules: As the instructor of this course, the University has given me the authority to require your compliance with these policies. If you do not comply with these requirements, I may ask you to leave the classroom, or I may need to cancel the class session entirely. In addition, failure to comply with these requirements may result in a referral to the Office of the Dean of Student Life to consider charges under PSU’s Code of Conduct. A student found to have violated a university rule (or rules) through the due process of student conduct might face disciplinary and educational sanctions (or consequences). For a complete list of sanctions, see Section 14 of the Student Code of Conduct & Responsibility.

Guidance May Change: Please note that the University rules, policies, and guidance may change at any time at the direction of the CDC, State, or County requirements. Please review the University’s main COVID-19 Response webpage and look for emails from the University on these topics.