University of the Pacific

Machine Learning - ANLT 222

Instructor: Dr. Anahita Zarei

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Schedule: We will have 2 different weeks: Live and Online. In “Live” weeks (Weeks 1, 3, 5, 6, 8, and 10), we meet on Saturdays in San Francisco at the University of the Pacific room 136D from 1:00-3:00 pm. We will also be meeting online on Wednesdays from 6:00-8:00 pm via WebEx. In “Online” weeks (Weeks 2, 4, 7, and 9), we will not meet in San Francisco. We will only be meeting online on Wednesdays from 6:00-8:00 pm via WebEx.

Prerequisites:

1. Introductory Linear Algebra (Vectors and Matrix Operations)
2. Introductory Statistics (Basic Probability Theory and Statistics)
3. Calculus I (derivatives)

Textbook: No specific textbook is required for this course. However, I recommend the following books for futher reading:

1. ***Machine Learning*** by Tom Mitchell
2. ***Learning from Data*** by Y. Abu-Mostafa, M, Ismail, and H. Lin. (On reserve at the front desk. Ask me or Prof. Hutley)
3. ***An Introduction to Statistical Learning: with Applications in R*** by Gareth James
4. ***Networks and Deep Learning*** by Michael Nielsen
5. ***Deep Learning*** by Ian Goodfellow and Yoshua Bengio and Aaron Courville. (Available here for free (http://www.deeplearningbook.org/))
6. ***Deep Learning with Python*** by Chollet

Course Description: This course introduces the theory and application of machine learning for uncovering patterns and relationships contained in large data sets. Machine learning algorithms offer a complimentary set of analytical techniques to statistical methods. Students will be exposed to the theory underlying supervised and unsupervised learning methods. Practical application of these techniques will be introduced using R. Additionally, students will learn proper techniques for developing, training, and cross validating predictive models; bias versus variance; and will explore the practical usage of these techniques in business and scientific environments.

Course Learning Objectives: Upon completion of this course students should be able to

1. Differentiate between machine learning and statistical methods for data science.
2. Demonstrate how to prepare data for the training, validation, and cross-validation of machine learning algorithms
3. Differentiate between stochastic and deterministic noise
4. Demonstrate how to test for, and avoid, overfitting predictive models.
5. Describe different learning algorithms such as K-nearest-neighbor, K-means clustering, Kernel Regressions, and RBF.
6. Describe various artificial neural network topologies and the impact of changing the input layer, output layer, and the number of hidden layers.

7. Apply ConvNets to large data sets for classification.
8. Apply machine learning techniques to create models using a real-world scenario and data set.

Assignments: The objective of the assignments is to provide you the opportunity to obtain a deeper understanding of the material and to see applications of the concepts discussed in lectures.

Late assignments will not be accepted.

Participation: You're expected to participate in class and WebEx discussions and contribute to weekly group assignments. Your participation grade will be based on self and peer evaluations on each group assignment and instructor assessment.

Exams: There will be a final exam, 1 hour and 55 minutes on the 10th week. It will be proctored inclass. As such all students must attend class on this day. If you're not able to come to class on the exam day you need to inform me by the end of the first week.

There will be no makeups.

Grading: The final grade is calculated based on the following weightings:

- Assignments: 40%
- Participation: 10%
- Exams: 50%

The overall grades will be assigned on a curve.

Continuation & Completion Policy: A grade of C or above is required on each course in order to pass. As students are required to pass all courses within the overall program in order to graduate, failure to achieve a passing grade in any one course will result in the student's inability to continue.

Collection of Work for Assessment: Student work may be retained to assess how course learning objectives are being met and for accreditation purposes.

Attendance Policy: Students are expected to attend all classroom sessions in person. Students who are unable to make any required session for unavoidable reasons must inform their instructor and gain approval for their impending absence in advance. Students are expected to make up the material covered when they are absent, and they are responsible for being aware of any announcements made during their absence(s).

Honor Code: The University Honor Codes states:

Cheating: is the willful giving or receiving of an unauthorized or dishonest advantage to/from another. Examples of cheating include, but are not limited to:

- Use of resources not authorized by the instructor or readily available to all students in the course.
- Copying assignments from another student or giving one's work to be copied or used by another student.
- Working together on an assignment when not specifically permitted by the instructor.
- Looking at another student's paper/computer screen during an examination, allowing a student to look at one's paper/computer screen, or giving answers to another during an examination.
- Looking at text or notes during an examination when not specifically permitted by the instructor.
- Doing homework, taking an exam, writing a paper, or doing any other coursework for another student or allowing another person to do it for you, when not specifically permitted by the instructor.

- Using any technological/communication tool not authorized by the instructor during an exam.
- Engaging in behavior specifically prohibited by an instructor during class discussions, in the course syllabus, or via other course-specific communication means or tools.

Plagiarism: Presenting as one's own, the work or the opinions of someone else without proper acknowledgment. Plagiarism includes, but is not limited to:

- Submitting an assignment, whole or in part, obtained from the internet or other unauthorized resources.
- Failing to give credit for ideas, statements of facts, or conclusions derived by another author; failure to use quotation marks when quoting directly from another, whether it is a paragraph, a sentence, or part thereof; failure to cite properly the work of another person.
- Submitting an assignment purchased or obtained from a "research" or term paper service.

Note: The full text of the University's Academic Honesty Policy can be found here (http://web.pacific.edu/x30642.xml)

The School of Engineering and Computer Science holds all of its students to a strict standard of academic integrity. In the case of a suspected violation of the University academic honor code, the faculty member will evaluate the alleged infraction and may take a range of actions up to and as severe as submitting an "F" or "No credit" for the course resulting in dismissal from the program. The faculty member will also report it immediately to the Program Director, who may further inform the School Assistant Dean's office, and the Office of Student Conduct and Community Standards. The Assistant Dean's Office and the Office of Judicial Affairs may pursue further sanctions, up to and as severe as disqualification from the University, based in part on the seriousness of the incident and any prior violations. not expired.

Honor Code Additions for this Course: In addition to Pacific's honor code, this course applies specific rules pertaining to student coursework:

Students may be placed into groups for the purposes of collaborating on specific assignments. Students may discuss the assignment, share thoughts and ideas on how to approach the assignment, and materials, including text documents, mathematical algorithms, or computer program code that will be submitted as a team assignment. Such sharing may only occur with members of the same team. Individuals/teams may not discuss or share ideas or materials with anyone outside of their assigned team. Ethics is an especially important issue in data science and must be adhered to at all times. In particular, students must adhere strictly to the Pacific Honor Code when working off campus, for example, during internships and Capstone assignments.

Failing to abide by the honor code can have very serious consequences and we are here to help you remain in compliance. If you have any questions regarding the honor code or suspect that what you are considering could in any way violate the honor code, you should seek guidance from a faculty member or the program director.

Support for Students with Disabilities: If you are a student with a disability who requires accommodations, please contact the Director of the Office of Services for Students with Disabilities (SSD) for information on how to obtain an Accommodations Request Letter. Requests are handled on a casebycase basis. To initiate the process, please contact the SSD Director by phone at (209)946-3221 or by email at dnuss@pacific.edu (mailto:dnuss@pacific.edu). To ensure timeliness of services, it is preferable that you obtain the accommodation letter(s) from the Office of SSD at the start of the semester or earlier. After the instructor receives the accommodation letter, please schedule a meeting with the instructor during office hours or some other mutually convenient time to arrange the accommodation(s). The Office of Services for Students with Disabilities is located at the Stockton campus in the McCaffrey Center, Rm. 136B.

- Phone: (209)946-3221
- Email: ssd@pacific.edu (mailto:ssd@pacific.edu)

- Online: www.pacific.edu/disabilities

Week	Covered Topics
1 & 2	Introduction to Machine Learning
	K Nearest Neighbor
	Logistic Regression
3 & 4	Kernel Regression
	Radial Basis Function Network
	Clustering
	Validation
5	Midterm
6 & 7	Bias and Variance
	Stochastic and Deterministic Noise
	Regularization
8 & 9	Ridge and Lasso
	Naive Bayes
	Artificial Neural Networks
10	Review/ Final Exam