

CS 4900/5900: Machine Learning Fall 2019

Class Meetings: Tue, Thu 1:30–2:50pm, ARC 321

Instructor: Razvan Bunescu

Office: Stocker 341

Office Hours: Tue, Thu 3:00–4:00pm, or by email appointment

Email: bunescu @ ohio edu

Class Website: <http://ace.cs.ohio.edu/~razvan/courses/ml4900>

Prerequisites:

Students are expected to be comfortable with programming and familiar with basic concepts in linear algebra and statistics.

Textbook:

There is no textbook for this class. Slides and supplementary materials will be made available on the course website.

Course Description:

This course will cover classification, regression and clustering algorithms, as well as introductory concepts in reinforcement learning. Topics include regularization, perceptrons, logistic regression, linear regression, Naive Bayes, nearest neighbors, Support Vector Machines, and Q-learning. The description of the formal properties of the algorithms will be supplemented with motivating applications in a wide range of areas including natural language processing, computer vision, bioinformatics, and music analysis. The fundamental topics covered in this course will prepare students for taking more advanced courses in deep learning and data mining.

Course Outcomes:

1. *Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.* Students will be able to:

- Indicate what machine learning algorithm is appropriate for a given problem.
- Use the technique of Lagrange Multipliers to solve an optimization problem.
- Use regularization techniques to alleviate overfitting.
- Use gradient descent to solve optimization problems.
- Explain the importance of smoothing in probabilistic models.

2. *Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the programs discipline.* Students will be able to:

- Create feature vector representations appropriate for a given problem.
- Implement simple learning algorithms such as kernel perceptrons, ridge regression, nearest neighbors, or Q-learning.
- Use third-party machine learning packages.

- Use standard techniques such as k-fold cross-validation to conduct rigorous experimental evaluations.

6. *Apply computer science theory and software development fundamentals to produce computing-based solutions.* Students will be able to:

- Use numerical approximations of gradients in order to verify gradient implementations.
- Apply vectorization techniques to exploit parallelization.

Grading:

50%: Homework Assignments

20%: Midterm Exam (Oct 15, in class)

30%: Final Exam (Dec 10, 12:20pm – 2:20pm)

Grading Scale:

A (> 92%) A–(> 90%) B+(> 87%) B(> 83%) B–(> 80%)

C+(> 77%) C(> 73%) C–(> 70%) D+(> 67%) D(> 63%) D–(> 60%)

Course and Attendance policies:

Assignments: All homework assignments are due before the class. You receive a budget of 5 slip days to use throughout the semester. Any number of these days can be applied to any homework assignment to extend the deadline for that assignment. For example, you can turn the first assignment in 2 days late and the fourth assignment 3 days late. After your slip days are exhausted, each day of lateness will incur a 20% penalty to that assignment's grade. Plan your slip day budget accordingly, e.g., be sure to save them up if you know you'll be traveling for a conference around a due date for a later project. Additional extensions may be granted in cases of medical or other types of emergencies, but must be agreed on with the instructor before the project's original due date.

Attendance: It is in your best interest to attend the lectures. Some of the material will not be found in the supplementary text or on the slides. Extra credit will be awarded for class activity. Also, be sure to check your OU email for important announcements on a regular basis.

Academic Dishonesty Policy:

All work must be the student's own. All external references used in reports must be properly cited. No credit will be given for duplicate or plagiarized work. Additional measures may be imposed by the University Judiciaries, when conditions warrant. Students may appeal academic sanctions through the grade appeal process. The OU Student Code of Conduct Policy is available online at:

<http://www.ohio.edu/communitystandards/academic/students.cfm>

Disability-based Accommodation:

Any student who suspects s/he may need an accommodation based on the impact of a disability should contact the class instructor privately to discuss the student's specific needs and provide written documentation from the Office of Student Accessibility Services. If the student is not yet registered as a student with a disability, s/he should contact the Office of Student Accessibility Services.

Mental Health and Wellness:

College can be a stressful time, and many things can prevent you from performing at your best, including strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. If you find yourself dealing with these or other issues that affect your mental health or academic performance, Ohio University offers services that can help. Drop-in counseling is available in Hudson Hall (3rd floor) from 9:45-3:15 Monday-Friday, as well as Counselor-in-Residence hours Sunday-Thursday from 5-10 pm in Living Learning Center, Room 160. Services are free to students with the OHIO Guarantee. If you need immediate assistance, you may call (740) 593-1616 24 hours per day, 7 days a week. For additional resources, visit:

<http://www.ohio.edu/student-affairs/counseling>.

Other Policies:

Be sure to notify the professor of any exam conflicts or other extenuating circumstances well in advance. No missed exams will be made up without prior approval. Medical excuse forms need to explicitly mention that the student could not have attended the exam at the specified time due to health concerns.