CS495/595 Introduction to Machine Learning

Spring 2020, TR 1:30 pm – 2:45 pm

Location: DRGS 2106

Instructor:

Jiangwen Sun, Ph.D., Assistant Professor, CS Department

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Office Hours: Tuesday 11:00 am – 12:00 pm (other times by appointment)

Teaching Assistant:

None

Prerequisite:

Knowledge of elementary calculus and linear algebra and probability theory. Basic computer skills and programming experience.

Course Description:

The objective of the course is to introduce basic concepts and commonly used algorithms in machine learning to students, and enable them to use machine learning methods in real-life applications. This course covers basic topics of machine learning, such as supervised learning (e.g., classification and regression) methods and their evaluation, unsupervised learning (e.g., clustering and dimension reduction) and their evaluation. Because of the diversity in machine learning topics, the materials covered in this course may vary among semesters.

Approaches:

The course consists of **lectures**, **quizzes**, **homework** and **project**. Lectures serve as the vehicle for the instructor to introduce concepts and knowledge to students. Homework provides the opportunity to students for them to practice what they learn during the lectures. Quizzes are used to test if certain basic concepts have been mastered. A course project will be used for students to get profound hands-on experience by applying machine learning methods learned in class to an interesting dataset or exploring a new machine learning topic. Participation in lectures is encouraged during the class.

Students are encouraged to form study groups to facilitate discussion. Each group is expected to consist of up to three students. As part of the course, the students will work on a term project where each group can choose to either apply the machine learning methods discussed in class to an interesting dataset or explore a new machine learning topic. At the end of the semester, each team is required to present the project in classroom and submit a report regular research paper format. The instructor will prepare a list of projects that students can choose from to work on. Students are also very encouraged to identify a project themselves. This exercise will help the team gain much deeper insights into certain algorithms and promote collaborations among team members.

Topics and Tentative Schedule:

Week	Topics	Note
Week 1 *(Jan. 13 ~ Jan. 17)*	Introduction: supervised and unsupervised learning problems, different learning tasks, etc. Review of basic mathematics (matrix computation, norms, probability, mean, variance, etc.)	
Week 2 *(Jan. 20 ~Jan. 24)*	Continue review of basic mathematics Supervised learning – regression: overview, linear regression, overfitting VS underfitting, ridge regression, Lasso	
Week 3 *(Jan. 27 ~ Jan. 31)*	Continue regression	HW1 out
Week 4 *(Feb. 3 ~ Feb. 7)*	Continue regression Supervised Learning – classification: overview, logistic regression, neural network (MLP, CNN), model evaluation	
Week 5 *(Feb. 10 ~ Feb. 14)*	In-class quiz (60 minutes) Continue classification	HW 2 out
Week 6 *(Feb. 17 ~ Feb. 21)*	Continue classification	HW3 out
Week 7 *(Feb. 24 ~ Feb. 28)*	Continue classification Unsupervised learning – clustering: overview, K-means, hierarchical clustering, DBSCAN, clustering evaluation	
Week 8 *(Mar. 2 ~ Mar. 6)*	Continue clustering	HW4 out
Week 9 *(Mar. 9 ~ Mar. 13)*		No class (Spring Holiday)
Week 10 *(Mar. 16 ~ Mar. 20)*	Continue clustering In-class quiz (60 minutes)	Project proposal due by Mar. 20th
Week 11 *(Mar. 23 ~ Mar. 27)*	Continue clustering	
Week 12 *(Mar. 30 ~ Apr. 3)*	Continue clustering More classification methods: KNN, Naïve Bayes, Decision Tree, support vector machine	
Week 13 *(Apr. 6 ~ Apr. 10)*	Continue classfication	
Week 14 *(Apr. 13 ~ Apr. 17)*	Unsupervised learning – dimension reduction: PCA, CCA	
Week 15 *(Apr. 20 ~ Apr. 24)*	Project presentations: Student teams present their final term projects	
Final Week	A final comprehensive quiz	

Textbooks:

- Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, ISBN-10: 0321321367
- Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop, ISBN-10: 0387310738
- Deep Learning (Adaptive Computation and Machine Learning Series) by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, ISBN-10: 0262035618

- Pattern Classification (2nd Edition) by Richard O. Duda, Peter E. Hart and David G. Stork, ISBN-10: 0471056693

None of the textbooks will be required. However, having one or two of them may complement and expand the materials discussed in lectures. Lectures will come with slide files and tutorial/review papers for students to study after lectures.

Attendance Policy:

Students are expected to attend classes regularly.

Grading Policy:

- Attendance: 10%
- Close-book quizzes (2 in-class quizzes and 1 final quiz): 40% (10% each for the two in-class quizzes, 20% for the final)
- Homework assignments (4): 20%
- Term Project (1): 30%
- Homework assignment due date extension policy
    - Any submission that is more than THREE days past due will NOT be graded
    - Everyone gets ONE time free 3-day extension
    - After that, all past-due submissions will be graded with this formula: $0.5^N \times g$, where N is the number of days past due and g is the grade of the submission as if it were on time.
- This course requires a lot of interaction, and thus discussions of ideas are encouraged. However, for all homework assignments, students are expected to write their OWN code, simple sharing and copying are prohibited, which will be considered as a violation of honor code.

Drop Policy:

As per University guidelines. See the University Calendar for drop dates.

Disabilities:

Old Dominion University is committed to ensuring equal access to all qualified students with disabilities in accordance with the Americans with Disabilities Act. The Office of Educational Accessibility (OEA) is the campus office that works with students who have disabilities to provide and/or arrange reasonable accommodations.

- If you experience a disability which will impact your ability to access any aspect of my class, please present me with an accommodation letter from OEA so that we can work together to ensure that appropriate accommodations are available to you.
- If you feel that you will experience barriers to your ability to learn and/or testing in my class but do not have an accommodation letter, please consider scheduling an appointment with OEA to determine if academic accommodations are necessary.

The Office of Educational Accessibility is located at 1021 Student Success Center and their phone number is (757)683-4655. Additional information is available at the OEA website: http://www.odu.edu/educationalaccessibility/

Honor Code:

Students are expected to follow the ODU Honor Code for all assignments and exams. Any violations will be dealt with strictly according to university policy. Despite that this course requires a lot of interaction, and thus discussions of ideas are encouraged, **the work that you turn in must be your own**.

Academic Dishonesty:

Old Dominion University is committed to students' personal and academic success. In order to achieve this vision, students, faculty, and staff work together to create an environment that provides the best opportunity for academic inquiry and learning. All students must be honest and forthright in their academic studies. Your work in this course and classroom behavior must align with the expectations outlined in the Code of Student Conduct, which can be found at www.odu.edu/oscai. The following behaviors along with classroom disruptions violate this policy, corrupt the educational process, and will not be tolerated.

Cheating: Using unauthorized assistance, materials, study aids, or other information in any academic exercise.

Plagiarism: Using someone else's language, ideas, or other original material without acknowledging its source in any academic exercise.

Fabrication: Inventing, altering or falsifying any data, citation or information in any academic exercise.

Facilitation: Helping another student commit, or attempt to commit, any Academic Integrity violation, or failure to report suspected Academic Integrity violations to a faculty member.

Academic dishonesty will be reported to the Office of Student Conduct & Academic Integrity and may result in sanctions up to and including expulsion from the University.