CS 722/822: Machine Learning -- Fall 2022

Course Information

Instructor: Dr. Fengjiao Wang, Web: https://fengjiaowang7.github.io

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Class Hours & Location: TR 9:30am - 10:45am, ECSB 2120

Office Hours: T 4:00pm - 5:00pm or by appointment, In Zoom https://odu.zoom.us/j/99578076648?pwd=ZVRGRVdkL0VNcXQ2Y0tDZ0M5dFowUT09

Course website: https://github.com/fengjiaowang7/CS722_fall2022

Piazza: https://piazza.com/class/l7g2pebp3u17n7

Canvas: https://canvas.odu.edu/courses/116018

Prerequisites: Knowledge of linear algebra, probability theory, calculus and optimization. Basic computer skills and programming experience with one or more following languages: Python (preferred), MATLAB, R, Java and C++.

Course Description

The objective of the course is to introduce basic and advanced concepts 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 (classification, regression, feature selection, etc.), unsupervised learning (clustering, dimension reduction, or component analysis, etc.) and some advanced/emerging topics, such as deep learning, and semi-supervised learning.

Course Objective

Student learning outcomes:

- Understand and explain the basic concepts/topics in machine learning.
- Understand the process of machine learning: formalize machine learning problem, data collection, preparation, modeling, evaluation.
- Develop an appreciation of latest machine learning literature.
- Individually work on machine learning projects involves real-world applications.
- Be comfortable using commercial and open source tools such as python and associated libraries.

Required/Optional materials

List of optional but recommended materials. 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.

▪ 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

Course Structure and Tentative Course Schedule

Structure: This course is lecture-based course that consists of lectures, in-class quizzes, and homework assignments. Lectures will serve as the vehicle for the instructor to introduce concepts and knowledge to students. 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. It is an **individual** project. The project is about using machine learning knowledge learned in class to solve real-world problems. The goal of the project are two folds: 1. how to formulate a real-world problem into a machine learning problem. 2. Implement machine learning solutions to solve the problem.

Participation in lectures is required during the class. Attendance will be count towards final grade. The course may also contain guest lectures from related fields and respective experts.

Topics: The tentative topics are as follows.

Week	Topics	Note
Week 1 (8/29-9/2)	Course overview Review of basic mathematics (matrix computation, norms, probability, mean, variance, optimization, etc.)	
Week 2 (9/5-9/9)	Continue review of basic mathematics Supervised Learning - regression: overview, least square, overfitting, regularization (ridge, Lasso)	
Week 3 (9/12-9/16)	continue regression	
Week 4	Supervised Learning - classification: overview, KNN, linear discriminant	

(9/19-9/23)	analysis, logistic regression, support vector machine, model evaluation, overfitting, regularization	
Week 5 (9/26-9/30)	In-class quiz (60 minutes) Continue classification	
Week 6 (10/3 - 10/7)	Continue classification	
Week 7 (10/10-10/14)	Continue classification	No class on 10/11 (Fall Holiday)
Week 8 (10/17-10/21)	In-class quiz (60 minutes)	
Week 9 (10/24 - 10/28)	Unsupervised Learning - clustering: K-means, hierarchical clustering, DBSCAN, spectral clustering, Gaussian mixture model, evaluation	
Week 10 (10/31-11/4)	Continue clustering	
Week 11 (11/7-11/11)	Continue clustering	No class on 11/8 (Election Day)
Week 12 (11/14-11/18)	In-class quiz (60 minutes) Supervised learning - support vector machine	
Week 13 (11/21-11/25)	Unsupervised learning - dimension reduction: PCA	No class on 11/24 (Thanksgiving)
Week 14 (11/28-12/2)	Deep Learning I	

Week 15 (12/5-12/9)	Deep Learning II	Class ends on 12/9
Final Week	A final comprehensive quiz	

Communication

Piazza: All lecture or assignment related questions can be asked through Piazza. Students can post public or private messages that can only be seen by instructor. You will be signed up by ODU email. Except the private message, all questions and answers can be seen by all students. Studets are encouraged to ask and answer others' questions in Piazza. We will endorse good student responses. We expect you to actively participate in online discussion at Piazza.

Canvas: All homework related or logistic related anouncements will be made through Canvas. All homeworks will be published in Canvas. Canvas will also be used for grade dissemination.

Email: If you send email to me, in the subject line, please be sure to start with "CS722" or "CS822". Please also include meaningful short message in the subject line. Failure to follow these guidelines may result in delayed response.

Grading Policy:

- Attendance: 5%
- Close-book quizzes (3 in-class quizzes, each quiz is 10%): 30%
- Non-programming homework assignment (2 assignments): 5%
- Programming-involved homework assignment (3 assignments): 30%
- Course project: this is an **individual** project. 30%

    (1) proposal 5%

    (2) milestone report 5%

    (3) project presentation 5%

    (4) report: 15%

Due Dates

All assignments are maked with an explicit due date, and are due at the end of that day (11:59:59PM, ET). All assigments will be published and annouced in Canvas.

Late submissions for homework assignment including programming and non-programming will be accepted. After the due date, students will have 2 additional days to submit the home work without any penalty. After those 2 additional days, homeworks will be accepted within the next 5 days with 30% discount. Any submission of homework assignment that is more than 7 days past due will NOT be graded.

Late submissions will not be accepted once the scheduled starting time of the final exam has begun.

> Exceptions to these dates will be made only in situations of unusual and un-forseeable circumstances beyond the student's control.

"I've fallen behind and can't catch up", "I'm having a busier semester than I expected", or "I registered for too many classes this semester" are not grounds for an extension.

Grading scale:

A: 94-100, A-: 90-93, B+: 87-89, B: 84-86, B-: 80-83, C+: 77-79, C: 74-76, C-: 70-73, D: 60-69 ,F: <=59

There is no separate grading scale for PhD students, but PhD students will typically be held a higher standard.

Course Policy - Academic Honesty

Everything turned in for grading in this course must be your own work.

The instructor reserves the right to question a student orally or in writing and to use his evaluation of the student's understanding of the assignment and of the submitted solution as evidence of cheating. Violations will be reported to the Office of Student Conduct Academic Integrity for consideration for possible punitive action.

Students who contribute to violations by sharing their code/designs with others may be subject to the same penalties.

This policy is *not* intended to prevent students from providing legitimate assistance to one another. Students are encouraged to seek/provide one another aid in learning and in issues pertaining to the programming language, or to general issues relating to the course subject matter. If you do have a chat with another student about a problem, you must inform me by writing a note on your submission (e.g., Bob pointed me to the relevant section for problem 3).

The basic rule is that no student should explicitly share a solution for an ongoing assignment with another student nor discuss code/formular in detail. But it is okay to share general approaches, directions, and so on. If you feel like you have an issue that needs clarification, feel free to contact me.

If you find anything online which is used in your homework/project, please refer it properly.

Educational Accessibility

Old Dominion University is committed to ensuring equal access to all qualified students with disabilities in accordance with the Americans with Disabilities Act (ADA). 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 the course, 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 complete examinations in the course but do not have an accommodation letter, 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.