Course Information

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

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Class Hours & Location: TR 5:45pm - 7:00pm, DRAGAS HALL 1117

Office Hours: TR 1:00pm -2:00pm or by appointment, In Zoom

TA: Muntabir Choudhury, Email: mchou001@odu.edu, Office Hours: TBD

Website: https://github.com/fengjiaowang7/CS722822

Piazza: https://piazza.com/odu/fall2021/cs722822

Blackboard: https://www.blackboard.odu.edu/

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, and review state of the art literature in machine learning. 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. Usually the emerging topics will be identified by reviewing the latest publications in top venues, such as ICML, NIPS, SIGKDD, etc. Because of the diversity in machine learning topics, the materials covered in this course may vary among semesters.

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: Course is divided into two units. Unit-I is the lecture unit 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.

Unit-II is a seminar style unit that includes paper reviews, student presentations of reviewed papers. A pre-selected list of papers will be provided. Each student will need to select one paper from the list and pick a time slot to present the paper. Each time slot is 35 minutes. Presentation will last 30 minutes, 5 minutes for questions. Though student only present one paper from the list, but you are expected to read papers others will present. The end result from such reading is a summary.

A course project will be used for students to get profound hands-on experience. It is an individual project. The project is based the paper one selected to present. The idea for the course project is to program machine learning algorithms from the selected paper. Further improvement based on the algorithms from the select paper is encouraged.

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.

Duration: Unit-I is covered in 7 weeks, Unit-II is covered in 8 weeks. The course project overlaps with Unit-I and II is spread over 15 weeks. See the topics below for more information.

Topics: The tentative topics are as follows.

Week	Topics	Note
Week 1 (8/30-9/3)	Course overview Review of basic mathematics (matrix computation, norms, probability, mean, variance, optimization, etc.)	
Week 2	Supervised Learning - classification: KNN, linear discriminant analysis,	

(9/6-9/10)	logistic regression, support vector machine, model evaluation, overfitting, regularization	
Week 3 (9/13-9/17)	continue classification	
Week 4 (9/20-9/24)	continue classification In-class quiz (45 minutes)	
Week 5 (9/27-10/1)	Unsupervised Learning - clustering: K-means, hierarchical clustering, DBSCAN, spectral clustering, Gaussian mixture model, evaluation	
Week 6 (10/4 - 10/8)	continue clustering	
Week 7 (10/11-10/15)	continue clustering In-class quiz (45 minutes)	No class on 10/12 (Fall Holiday)
Week 8 (10/18-10/22)	start of unit-II paper reviews and presentation	
Week 9 (10/25 - 10/29)	Continue unit-II	
Week 10 (11/1-11/5)	Continue unit-II	No class on 11/2 (Election Day)
Week 11 (11/8-11/12)	Continue unit-II	
Week 12 (11/15-11/19)	Continue unit-II	
Week 13 (11/22-11/26)	Continue unit-II	No class on 11/25 (Thanksgiving)
Week 14		

(11/29-12/3)	Continue unit-II	
Week 15 (12/6-12/10)	course project presentation	Class ends on 12/10
Final Week	A final comprehensive quiz	

Communication

Piazza: All homework related anouncements will be made through Piazza. All questions will be fielded through Piazza. The primary benefit is that for many questions everyone can see the answers and other students can answer as well. I will endorse good student responses. Additionally, I expect you to actively participate in online discussion at Piazza. You can post public or private messages that can only be seen by instructor. You will be signed up by ODU email.

Blackboard: Blackboard will be used primarily for grade dissemination. Some important anouncements will also be made in Blackboard.

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 (2 in-class quizzes and 1 final quiz): 25%

- Non-programming homework assignment (2): 5%

- Programming-involved homework assignment (3): 15%

- Paper review summary: 10%

- Course project: this is an **individual** project. 40%

    (1) Paper review presentation: 10% of 40%

    (2) Course project presentation and report: 30% of 40% (implementing selected algorithms from a recent publication, make improvements based on it)

Due Dates

Most assignments are maked with an explicit due date, and are due at the end of that day (11:59:59PM, ET). You will find these dates in course website.

Late submissions for homework assignment including programming and non-programming will be accepted, at a 10% per day penalty, up until one week after due date. Any submission of homework assignment that is more than 7 days past due will NOT be graded.

Due date for paper review summary is one day before the paper is presented. For example, if paper will be presented at 10/19, due date for summary is 10/18 11:59:59PM EDT. Late submissions of paper review log is not accepted. Everyone can skip at most 3 submissions of paper review summary, which will not result in any penalty. Skipping over 3 submissions for paper review summary will result in deduction, with each one deduct 0.5%, till 0%.

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: 90-100, B: 80-89, C: 70-79, D: 60-69, Fail (Grade F): 0-59

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.