AI 539: Machine Learning II

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Office Hours: Th 3:20-4
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Class Hours: T/Th 2-3:20pm
Class Room: Kelley 1007

Course Description

Machine learning is a fast advancing field. This course, being our second class on Machine learning, will focus on advanced topics in machine learning that are not covered by AI534. The content of this course will evolve over time and can potentially change from year to year as there are many possible advanced topics that we can explore.

For this term, we will focus on two main topics (modules).

Module 1: Learning from structured data. Classic machine learning algorithms assumes examples to be independently and identically distributed. This assumption, however, is rarely valid in real world data. In practice, we often face much more complex data containing rich structure that can be helpful if used properly in learning.

In this module we will cover *structured prediction methods* for learning to predict structured outputs. This includes *Hidden Markov Models*, *Conditional Random Fields*, *Structured Perceptron and SVM*, and *search based structural prediction* methods. We will also discuss learning algorithms concerning structured inputs including *graph Kernels* and *Graph neural networks*.

Module 2: Improving data efficiency for learning. Machine learning systems rely on high quality training data to achieve good performance. In practice, labeled data can be scarce and expensive to acquire. How can we learn more efficiently with limited amount of labeled data or limited labeling budget? In this module, we will cover the topics of *active learning*, *bayesian optimization*, and *semi-supervised learning*. If time allows, we will also discuss *self-supervised learning*.

In addition to exposing students to select advanced topics in Machine Learning, this class will also aim to train student in reading research papers with critical thinking, as well as reviewing and presenting research.

The format of the class will be a mix of lecturing by the instructor, guest lectures on select topics, and student-led paper presentations and discussions.

Course materials

This class does not use a text book. The lecture notes and required reading will be available on Canvas.

Prerequisites/Corequisites

Prerequisite: AI534 or equivalent

Assessments and grading

The grade will be determined by the following components:

- Paper reading and review (individual based) (20%) There are a list of required papers for reading. Students must read the papers and write an ICML format review of each paper.
- Paper presentation and discussion (15%) (Group or individual based). Each group will pick one of the papers (students could potentially pick a paper outside of the provided list, but it needs to fit the general theme of the module and be approved by the instructor) to take a deep dive and present the paper and lead the discussion in class.
- Quizzes/Exams (20 %) There will be two quizzes/exams (week 5 and 10) to test the knowledge that are covered in the lectures and reading.
- Final project (group or individual based) (45%). For the project, each group will need to submit a proposal in week 4-5 (5 pts), a milestone report at week 7-8 (5 pts), a final project report (25 pts) and a final presentation (10 pts) in week 10-11. The project can be one of the following formats:
    1. an open ended research problem
    2. Addressing a practical application
    3. An in-depth replication and investigation of an existing paper

Grades are assigned based on the following scale:
A($\geq$94%), A-($\geq$ 90%), B+($\geq$ 86%), B($\geq$ 82%), B-($\geq$ 78%), C+($\geq$ 74%), C($\geq$ 70%), C-($\geq$ 65%), D+($\geq$ 60%), F($<$ 60%)

Course Policies

During Class

I expect students to attend all the classes and actively participate in class discussions, which will be a critical part of the class. I understand that the electronic recording of notes will be important for class and so computers will be allowed in class. Please refrain from using computers for anything but activities related to the class. Phones are prohibited as they are rarely useful for anything in the course. Eating and drinking are allowed in class but please refrain from it affecting the course.

Policies on Late Assignments

Late assignments will be accepted for no penalty if a valid excuse is communicated to the instructor before the deadline. After the deadline, assignments will be accepted for a 70% deduction to the score up to 2 days after the deadline. After this any assignments handed in will be given 0.

Accommodations for Disabilities

Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.eduLinks. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations.

Academic Honesty

The students are expected to be honest and ethical in their academic work. Please read the text about the University's Student Conduct Expectations through the following link: https://beav.es/codeofconduct

Any incident of academic dishonesty will be handled according to the University's Academic Regulations, as outlined in the url listed above.