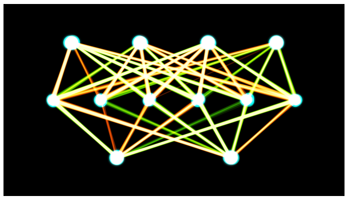
CSCI591
ST: Advanced Machine Learning
TR, 11:00AM-12:20PM, SS362



Instructor: Doug Brinkerhoff
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Office: SS403
Office Hours: TR, 12:20-2:00
(E-mail for an appointment, or my door is always open when I'm in)

Course Description: As a society we have reached a point where the amount of information available to us exceeds our capacity to analyze it without the assistance of the very computers that have made the collection of such vast sums of data possible. In this course we will explore the methods required to turn these data into state of the art predictive models. To do this, we will explore a broad distribution of "classic" papers in Machine Learning (particularly deep learning).

Learning Outcomes: At the completion of this course, students will be able to:
1. Read primary literature in the field of machine learning and implement the associated methods.
2. Understand the strengths and limitations of modern ML.
3. Teach the core concepts of various ML algorithms to peers.
4. Apply these algorithms to problems in their primary field of study.

Course Organization: We will read a new paper each week. Each week's paper will be principally assigned to two (occasionally three) students, who will be in charge of three tasks:
1. Preparing a 30-45 minute presentation distilling the key points of the paper. Note that this may require finding additional readings to shore up points of confusion and to fill in necessary background information!
2. Leading a group discussion on the paper. Preparation will involve devising questions to get things going again when discussion lags.
3. Devising an in-class exercise that involves the implementation and/or utilization of the key techniques of the paper. This could involve coding something like automatic differentiation from scratch, or implementing scaled-back version of ResNet in pytorch, or deriving a theoretical result.

Presentation and discussion will occur on Tuesdays, with the in-class exercise happening on Thursdays. Students *must* meet with the instructor prior to their assigned week(s) in order to agree upon the scope of the presentation, appropriateness of exercises, etc. Note that I will also ask all students to submit weekly responses to short conceptual questions to prove that they did the assigned readings.

Given that there are around 14 students in the class and 14 weeks of instructional time, each student will take the lead on two papers over the course of the semester. The first seven papers will be chosen and assigned by the instructor. They can be found on the course github page. The second set of seven papers will be selected by you (in consultation with the instructor, who has a substantial list of interesting potential topics).

Computers, Software, and Online Material: A laptop is required for this course. If you don't have one, let me know and I'll arrange a loaner. We may end up using a variety of software through this course: the capacity to successfully install a variety of packages is an essential prerequisite for this course.

The central repository for the course is its github page, which can be found at https://github.com/UM-CSCI-591-Spring-2020

Prerequisite(s): Officially, CSCI447/547: Machine Learning. In reality, this course requires a commitment to making up any knowledge gaps that the student might have with respect to the course material. Because of the nature of the subject, ML borrows heavily from topics in calculus, statistics, discrete math, and programming. It is unlikely that anyone is going to be comfortable with the course material all the time. Don't get too bent out of shape about it.

Text(s): No official text, but a good supplement to the papers that we will read is

1. *Deep Learning*, Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT
   Freely available at www.deeplearningbook.org

Grade Distribution:

Course Participation and Attendance	40%
Instructor Assignments	20%
Paper Leads	40%

Letter Grade Distribution:

>= 93.00	A	73.00 - 76.99	C
90.00 - 92.99	A-	70.00 - 72.99	C-
87.00 - 89.99	B+	67.00 - 69.99	D+
83.00 - 86.99	B	63.00 - 66.99	D
80.00 - 82.99	B-	60.00 - 62.99	D-
77.00 - 79.99	C+	<= 59.99	F

Attendance Policy: Attendance is generally required, as participation is a significant portion of your grade. However, I also understand that there are lots of good reasons for not being able to make it to class; just talk to me about it and chances are we can work something out.

Late Assignments: I will not accept late assignments unless an extension was agreed upon well in advance of the due date or in extenuating circumstances to be determined at my sole discretion.

Academic Integrity: All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. I will follow the guidelines given there. In cases of academic dishonesy, I will seek out the maximum allowable penalty.

Disabilities: Students with disabilities may request reasonable modifications by contacting me. The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. Reasonable means the University permits no fundamental alterations of academic standards or retroactive modifications.