Syllabus

CS 688
Machine Learning

Instructor
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Office Hours: TBA.

Teaching Assistant
TBA (tba [at] gmu [dot] edu)
Office Hours: TBA

Meets
Thursday, 4:30 to 7:10 PM, Planetary Hall 206.

Safe Return to Campus: Students are expected to follow the university's Safe-Return-to-Campus Policy (including mask wearing, daily health check, etc.) for attending any classes. Please check out the policy before coming to the campus and the classroom. Note that students who choose not to abide by these expectations will be referred to the Office of Student Conduct for failure to comply.

Textbook

Course Web Page
https://nlp.cs.gmu.edu/course/cs688-spring22/

We will use Blackboard for course materials/assignments/grading, and Piazza for Q&A (sign up link: TBA).

Course Description
Machine learning studies computer algorithms for learning to do things. For example, we might be interested in learning to complete a task, or to make accurate predictions, or to navigate in an unexplored environment. The learning that is being done is always based on some sort of observations or data, such as examples (the most common case in this course), direct experience, or instruction. So in general, machine learning is about learning to do better in the future based on what was experienced in the past. The emphasis of machine learning is on automatic methods. In other words, the goal is to devise learning algorithms that do the learning automatically without human intervention or assistance.

The machine learning paradigm can be viewed as "programming by example." Often we have a specific task in mind, such as recognizing handwritten digits on an envelope to perform automated mail dispatching. But rather than program the computer with rules to solve the task directly, in machine learning, we seek methods by which the computer will come up with its own program based on examples that we provide.

The course covers key algorithms and theory at the core of machine learning. Particular emphasis will be given to the statistical learning aspects of the field. Topics include: decision theory, Bayesian theory, curse of dimensionality, linear and non-linear dimensionality reduction techniques, classification, clustering, neural networks, kernel methods, mixture models and EM, ensemble methods, deep learning.

Prerequisites
- CS 580 or CS 584 or permission of instructor.
- Students should be experienced with writing substantial programs in Python.
- Students must be familiar with basic probability and statistics concepts, linear algebra, optimization, and multivariate calculus.

Please contact the instructor if you have questions about the necessary background.

Class Format
Lectures by the instructor. Besides material from the textbook, topics not discussed in the book may also be covered. Research papers and handouts of material not covered in the book will be made available. Grading will be based on participation, homeworks, a midterm exam, and a project. Homework assignments will be given and discussed in class. In order to learn the material and to do well on quizzes and the exam, students are required to work on the assignments. Graded work must be done on an individual basis, unless otherwise stated by the instructor. Any deviation from this policy will be considered a violation of the GMU Honor Code.

Classroom Specifics
I expect students to attend the class. I will supplement the textbook with extensive discussions and material. Students' active participation is very important to succeed in this course.

Some classes will include in-class exercises that will build on the material taught. These will be handed out (or will be small programming assignments) that I will ask you to complete in class. They will not be graded for their accuracy, but participating in the exercise and submitting something back will reflect your participation grade, along with short quizzes on the discussed material.

In two classes (one in the middle and one in the end of the semester), students will be asked to present their project progress.

Grading
There will be a small midterm exam (no final exam). Your final grade will be dependent on:

- **Homeworks (30%)**: There will be 3-5 homework assignments, scattered throughout the semester. Details [here](https://nlp.cs.gmu.edu/course/cs688-spring22/syllabus/).
- **Project (30%)**: You will give two presentations in class.
  - **Project Proposal Presentation (5%)**: In the middle of the semester, you will present your project proposal in class and will receive feedback from your classmates and the instructor. Similarly, you will be asked to provide feedback to your classmates’ proposals. The purpose is to (1) help you learn to evaluate others’ proposals and (2) allow you to further improve your own proposal by learning from your peers.
  - **Final Project Presentation (5%)**: In the last class, you will present your final project. Requirements on the presentation will be provided in time.
  - **Final Write-Up of your project (20%)**: By the end of the semester (and a few days before grades are due) you will have to submit a write-up of your project. Requirements on the write-up will be provided in time.
- **Participation (10%)**: See details above.
- **Midterm (30%)**: TBA.

**Late Day Policy**: No late days are allowed, but given that we’re still living in a pandemic, contact the instructor if you feel you need an extension for a deadline. In the case of a serious illness or other excused absence, as defined by university policies, coursework submissions will be accepted late by the same number of days as the excused absence. In case there are unforeseen circumstances that don’t let you turn in your assignments on time, you may submit part of an assignment on time for full credit and part of the assignment late with a penalty of 30% per week (that is, your score for that part will be \(0.7^\left\lfloor \frac{t}{7}\right\rfloor\), where \(s\) is your raw score and \(t\) is the possibly fractional number of weeks late). No part of the assignment may be submitted more than once. No work may be submitted after the final project due date.

**Readings**

For each topic/class the instructor will provide a list of papers as suggested readings. Students should be able to understand the course content just by following the lecture along with the textbook and by doing the readings.

**Tentative Schedule**

TBA

**Honor Code**

The class enforces the [GMU Honor Code](https://www.gmu.edu/about/gmu-honor-code), and the more specific code policy special to the Department of Computer Science. You will be expected to adhere to this code and policy.

**Note to Students**

Take care of yourself! As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, global pandemics, feeling down, difficulty concentrating and/or lack of motivation. All of us benefit from support during times of struggle. There are many helpful resources available on campus and an important part of having a healthy life is learning how to ask for help. Asking for support sooner rather than later is almost always helpful. GMU services are available, and treatment does work. You can learn more about confidential mental health services available on campus at [https://caps.gmu.edu](https://caps.gmu.edu). Support is always available (24/7) from Counseling and Psychological Services: 703-527-4077.

**Disabilities**

If you have a documented learning disability or other condition which may affect academic performance, make sure this documentation is on file with the [Office of Disability Services](https://ods.gmu.edu) and come talk to me about accommodations. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Services, I encourage you to contact them at ods@gmu.edu.

Last updated on Oct 5, 2021