COSC 410: Applied Machine Learning

Spring 2022 Syllabus
Prof. Noah Apthorpe

I. Overview

Description

This course provides a practical introduction to applied machine learning. It covers supervised and unsupervised machine learning algorithms, including regression, support vector machines, decision trees, nearest neighbors, clustering, and ensemble methods. The course also covers deep learning techniques, including feedforward, convolutional, and recurrent neural networks. Emphasis is placed on understanding and gaining hands-on experience with machine learning for practical use. The course culminates with a research-style term project involving a machine learning application of students' choice.

Learning Goals

Students who complete this course will learn to

1. Understand the practical details of a wide variety of machine learning algorithms
2. Program machine learning pipelines using off-the-shelf Python libraries
3. Design, conduct, and present a machine learning research project using self-collected or publicly available datasets

Recommended Background

COSC 202: Data Structures & Algorithms or similar experience is a prerequisite. You should be fluent programming in Python and comfortable using online resources to troubleshoot programming problems and learn new Python libraries. You do not need to have any prior experience with machine learning. Most importantly, you should be enthusiastic about class discussions and self-motivated to complete a substantial term project involving data selection, research programming, and proposal/progress/results presentations.

II. Professor Contact Info

Prof. Noah Apthorpe
311 McGregory Hall
napthorpe@colgate.edu
Email or message me on Slack to schedule a 1:1 meeting.

III. Logistics

All material for the course will be posted on Moodle**.**

Classes will involve a combination of lecture, guided practice, student-led discussion, and term project presentations.

Labs will involve hands-on **programming assignments** that must be submitted by the start of lab the following week.

Readings will be from the required textbook (below) as well as from academic papers, press articles, and technical reports provided on Moodle. Students will be expected to complete all assigned readings before class.

- Aurélien Géron. *Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, Second Edition.* 2019.

Term Project. You will form groups of three to design and conduct a research-style term project as the capstone for the course. Your project must involve the application of machine learning algorithms to a self-collected or publicly available dataset in order to investigate a meaningful research question. The term project is described in more detail in the Term Project Overview on Moodle.

Exams. There will be a midterm exam halfway through the semester and a final exam during the final examination period. All material from class, lab, and readings may appear on the exams. The exams will be closed book, and students will not be allowed to reference any outside materials during the exams.

Attendance and **participation** in the course are expected. There will be many opportunities to demonstrate participation, such as asking questions during class, contributing to discussions, and posting on Slack. Your participation grade will also include the completion of in-class worksheets and programming practice.

V. Grading

Students will receive the same grade for the class and the lab. Grades will be based on

- Programming Assignments (40%)
- Term Project (25%)
- Midterm Exam (15%)
- Final Exam (15%)
- Participation (5%)

Final course grades will be based on the percentage of total points earned weighted by the categories above on the following scale: A [93-100%], A- [90-93%), B+ [87-90%), B [83-87%), B- [80-83%), C+ [77-80%), C [73-77%), C- [70-73%), D+ [67-70%), D[60-67%), F [0-60%). Individual assignments or exams may be curved such that the curve will increase student grades.

VI. Important Policies

Late Policy

All **term project** deadlines are strict. Late submissions will receive zero credit. However, excuses for medical reasons or with approval from an administrative dean are legitimate exceptions and will not be penalized.

Late submission of **programming assignments** will be accepted according to the following policy:

- All students will start the semester with a balance of **7 "late days."**
- All programming assignments will be due at the start of the following lab.
- Every 24 hours (or fraction thereof) you submit a quiz or assignment late will subtract one late day from your balance. For example, if you submit an assignment 10 minutes late on the due date, you will lose 1 late day.
- If your late day balance remains nonnegative, there will be no penalty for a late submission.
- If you have no more late days, you will receive zero credit for submitting a late assignment.
- *Excuses with medical documentation or approval from an administrative dean are legitimate exceptions and will not count against your late days. Any other reason for lateness will reduce your late days.*

Attendance Policy

Students are expected to attend all class and lab sessions according to the following policy:

- Unexcused absences may require make-up work or result in grade penalties.
- Excused absences with medical documentation, approval from an administrative dean, or for other legitimate reasons (e.g. religious holidays, visa-related travel, etc.) will not count against this attendance expectation.
- Absences at the beginning of the semester before enrolling in the course will not count against this attendance expectation, but students who miss classes before enrolling must attend an office hour with Prof. Apthorpe to review missed material.
- Students must contact Prof. Apthorpe to verify excused absences *prior to the expected absence.*

Mask Policy

You are required to wear a mask while participating in this class. Violations of the mask policy in classrooms are treated as academic behavior misconduct. If you come to class without a mask, you will be asked to put one on. If you do not put on a mask when asked, you will have to leave class. This policy may change as the semester progresses in alignment with University guidance.

Classroom Expectations

You are expected to contribute to a learning environment that is respectful and conducive to the education of everyone in the course. Respect for different identities, backgrounds, and viewpoints must be maintained at all times. Laptops are allowed in class, but you must avoid multi-tasking or other use of electronic devices that may be distracting to yourself or others. Failure to adhere to these expectations may result in disciplinary action.

Academic Honesty

You are expected to abide by Colgate's Academic Honor Code in all cases. **Exams** must be completed on your own. You may not share answers to exam questions with any other individuals or organizations.

Copying code from any source and attributing it to yourself is unacceptable for any reason. However, this does not mean that you must independently write every line of code in your programming assignments. Software engineers are often expected to reuse code from their companies/institutions or online libraries. You are encouraged to import and use available Python libraries (e.g. Scikit-Learn, Numpy, Keras) for your term projects and programming assignments. You may also use **snippets** of code you find in library documentation or other online sources (e.g. Stack Overflow). All such code must be acknowledged in assignment submissions. Since the definition of a "snippet" can vary, please ask Prof. Apthorpe if you are uncertain whether you can use code from a particular source.

Content Sharing Policy

Content from this course, including lecture slides, Python notebooks, programming assignments, and exams, is the intellectual property of the faculty and may not be recorded, shared, or reproduced without the explicit, written consent of Prof. Apthorpe. You also may not record video or audio of class sessions without the explicit, written consent of Prof. Apthorpe. Doing so would be a breach of the Code of Student Conduct, and, in some cases, a violation of the Federal Education Rights and Privacy Act (FERPA).

Accommodations

If there is anything you believe may affect your learning in this class, please contact Prof. Apthorpe so appropriate arrangements can be made. Any information you share will be kept confidential to the extent allowed by University policy. Students are encouraged to reach out to other campus resources including their Administrative Dean, Student Health Services, Counseling Center, Academic Support and Disability Services, and Information Technology Services.

Feedback

Student feedback is important to help improve this course. You can provide anonymous feedback at any point in the semester using the Course Feedback item on Moodle.

Other Policies

If you have questions about any other course policies, please ask Prof. Apthorpe!