Intro and First Day Stuff

Lecture 1 - CMSE 381

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::
Dept of Computational Mathematics, Science & Engineering

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People in this lecture

Dr. Wang(she/her)
Depts of CMSE and Math

Maryclare Martin (she/they)
Graduate Student, CMSE, MSU

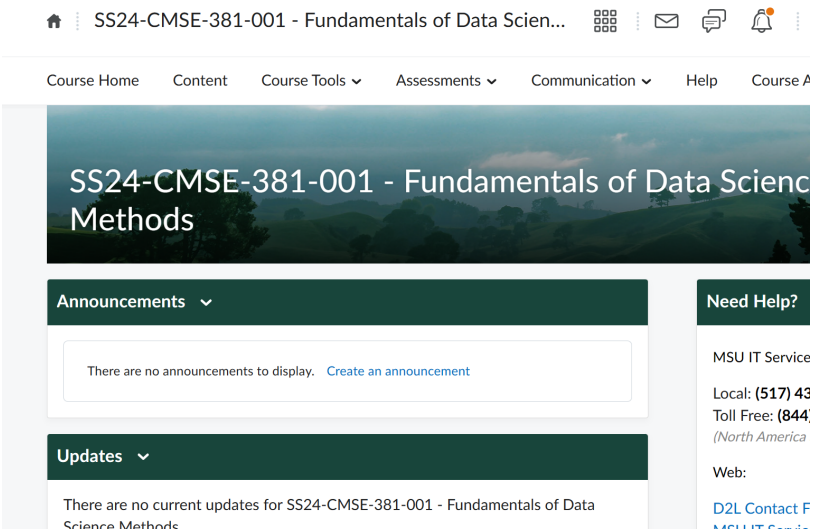
What is this course about?

Topics:

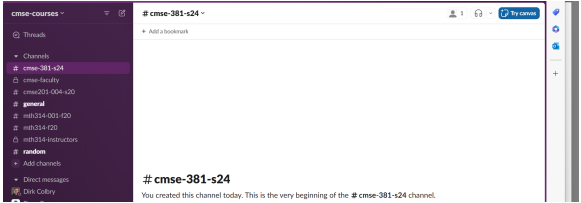
- Fundamental concepts of data science
- Regression
- Classification
- Dimension reduction
- Resampling methods
- Tree-based methods, etc.

D2L and where to find grades

https://d2l.msu.edu/d2l/home/1871821



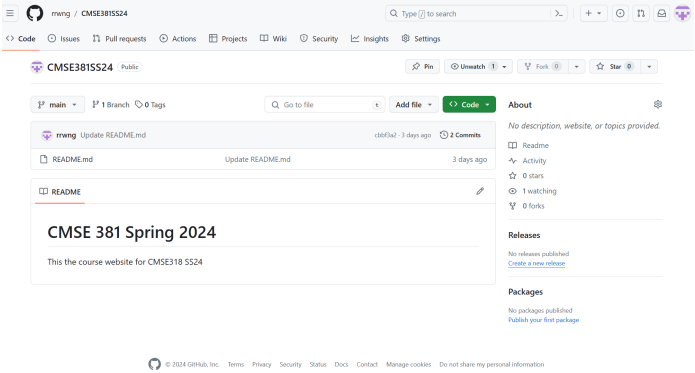
Slack and where to find announcements/ask questions



Expected answer time from the instructors: within 48 hours

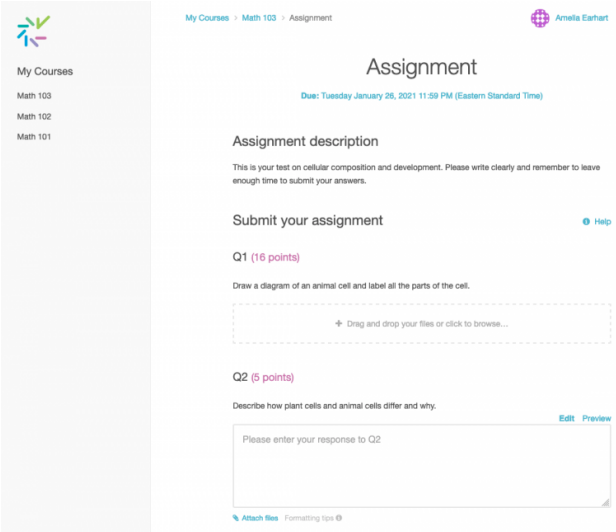
Github and where to find slides and jupyter notebooks

https://github.com/rrwng/CMSE381SS24/



Crowdmark and where to submit homework

No URL: You will get an automated email from the system (I think.....?)



Office hours

Zoom Meeting ID: 91303872529, Passcode: CMSE381

Dr. Wang

Wednesdays
Both 5pm - 7pm

Zoom

Maryclare Martin

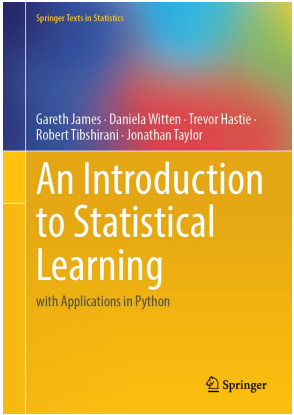
Tuesdays and Thursday 12:30 - 2:30pm,

Zoom (Meeting ID: 91303872529, Passcode: CMSE381)

Textbook

Free download

https://www.statlearning.com/



Class Structure

- Monday and Wednesday: lecture by Dr. Wang; Friday: recitation by TA and LA.
- Class is a combination of lecture time, and group work/coding time.
  - Bring computer every day
  - Jupyter notebooks
  - Python
- Every Friday, there will be a short check-in quiz. This will be basic content realted to lectures since the last class. Possible questions include checking on definitions, or basic understanding of major ideas.
  - Drop three lowest grades

Class Structure Pt 2

- Homeworks due once a week, midnight of the day marked in the schedule.
  - Drop two lowest grades
  - Sliding scale:
    - 24 hours late: 25% penalty.
    - 48 hours late: 50% penalty.
    - >48 hours: No late work accepted.
- In-class assignments due every Friday midnight.
  - drop two lowest grades
  - to be completed during the recitation
  - full credit for answering 2/3 of the questions correctly
- Two Midterms
  - See schedule for dates
  - Not cumulative
- Final exam

Approximate schedule

Schedule will be updated throughout the semester

Grade distribution

	Estimated Points
Homeworks	(11 homeworks - 2 lowest grades) $\times$ 10 points $=$ 90
Quizzes	(11 Quizzes - 3 lowest grades) $\times$ 3 points $=$ 24
In-class assignments	(12 - 2 lowest grades) $\times$ 2 points $=$ 20
Midterm	(2 Midterms) $\times$ 30 $=$ 60
Final exam	36
TOTAL:	230

Section 1

Intro to class

What is Statistical Learning?

Statistical Learning

- Subfield of statistics
- Emphasizes models and their interpretability, precision, and uncertainty

Machine Learning

- Machine learning has a greater emphasis on large scale applications and prediction accuracy.

Very blurred distinction at this point....

Why should you care?

Data is abundant and powerful, learning how to analyze data is critical.

- Web data, e-commerce (Amazon, JD, Alibaba)
- Car sales (Tesla, Ford, and GM)
- Sports team (MSU, Lions, etc)
- Politics and government

Learning Tools as Black Boxes

- Need to know what tool to use
- Need to know how to interpret output of the tool
- Don't need to rebuild the entire box from scratch

Example: Email spam

	`george`	`you`	`your`	`hp`	`free`	`hpl`	`!`	`our`	`re`	`edu`	`remove`
`spam`	0.00	2.26	1.38	0.02	0.52	0.01	0.51	0.51	0.13	0.01	0.28
`email`	1.27	1.27	0.44	0.90	0.07	0.43	0.11	0.18	0.42	0.29	0.01

if $(\texttt{\%george} < 0.6)$ & $(\texttt{\%you} > 1.5)$ then `spam` else `email`.

if $(0.2 \cdot \texttt{\%you} - 0.3 \cdot \texttt{\%george}) > 0$ then `spam` else `email`.

Supervised learning

- Outcome measurement Y (also called dependent variable, response, target, label).
- Vector of p independent measurements X (also called inputs, predictor, regressors, covariates, features, independent variables).
- In the regression problem, Y is quantitative (e.g price, blood pressure).
- In the classification problem, Y categorical, i.e., takes values in a finite, unordered set (survived/died, digit 0-9, cancer class of tissue sample).

Unsupervised learning

- No outcome variable, just a set of predictors (features) measured on a set of samples.
- Objective is fuzzier: find groups of samples that behave similarly, find features that behave similarly, find linear combinations of features with the most variation.
- Difficult to know how well you are are doing.
- Different from supervised learning but can be useful as a pre-processing step for supervised learning.

Section 2

Python Review Lab: Pt 1

Plan for the lab

- Find a group of 4 or so.
- Clone the class repository (or download the jupyter notebook and the csv file from github)
- Get started!

Using git

- `git clone https://github.com/rrwng/CMSE381SS24.git`
- from inside the folder you just made, run `git pull` any time you want to download new content

Generative AI discussion

Definition via Wikipedia:

> *Generative artificial intelligence (AI) is artificial intelligence capable of generating text, images, or other media, using generative models. Generative AI models learn the patterns and structure of their input training data and then generate new data that has similar characteristics.*

Examples:

- ChatGPT
- Bard
- DALL-E

- Get in a group of about 4.
- Open this google doc tinyurl.com/CMSE381-genAI
- In your group, brainstorm cases where someone might use generative AI in the context of our class.
- Download a copy of this google doc file and add your ideas to it, also add arguments for or against whether we should allow the use of that context in class.
- turn the file in along with the completed python-review notebook.

Next time

- Weds: What is statistical learning and model accuracy?
- Homework due next Wednesday
- no Quiz this week
- Office hours:
  - Dr. Wang: Wednesday 5-7pm
  - Maryclare: Tues and Thur 12:30pm - 2:30pm