

MS&E 125: Intro to Applied Statistics

Introduction

Professor Udell

Management Science and Engineering
Stanford

April 3, 2023

MS&E 125: Intro to Applied Statistics

want to take this class?

▶ **ASAP:**

- ▶ enroll (or drop)
- ▶ sign up for Ed
- ▶ sign up for polleverywhere
(visit `pollev.stanford.edu` and log in with your SUNetID)

links on course website:

<https://stanford-mse-125.github.io/website-2023/>

Outline

Meet and greet

Course topics and objectives

Logistics

Course staff

- ▶ Prof. Madeleine Udell
- ▶ CA: Mike Van Ness (MS&E PhD)
- ▶ CA: Josh Grossman (MS&E PhD)

Who am I?

academic

- ▶ B.S. in Mathematics and Physics at Yale
- ▶ Ph.D. in Computational and Mathematical Engineering at Stanford
- ▶ postdoctoral fellow at the Center for the Mathematics of Information at Caltech
- ▶ professor OR at Cornell / in MS&E at Stanford

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applied work

- ▶ finance: Goldman Sachs, BlackRock, Capital One, Schonfeld, Two Sigma, ...
- ▶ tech: Google, Retina.ai, Marketing Attribution
- ▶ cybersecurity: DARPA, Expanse (formerly Qadium)
- ▶ clean energy: Aurora Solar
- ▶ politics: Obama 2012
- ▶ also healthcare, supply chain, ...

Who are you?

poll:

- ▶ Majors: MS&E? Other majors?
- ▶ Future jobs: PMs, finance analysts, consultants, founders, data scientists, ???
- ▶ Year: 1st, sophomore, junior, senior, grad student?

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What is this class about? Intro

prereqs:

- ▶ basic coding
- ▶ basic probability
- ▶ basic linear algebra
- ▶ basic calculus

prereq means: if it's your first time seeing it, it will go very fast!

What is this class about? Applied

the most useful things

- ▶ preprocessing data
- ▶ assessing data
- ▶ selecting data
- ▶ making sense of results

but also: there is nothing more useful than a good theory

- ▶ how do we know? can we be sure?

What is this class about? Statistics

- ▶ quantitative assessment for important questions
 - ▶ hypothesis testing, confidence intervals, ...
- ▶ models
- ▶ data
- ▶ inference
- ▶ prediction
- ▶ uncertainty
- ▶ causality

Application: risk factors for heart failure

- ▶ collect data
- ▶ handle missing values
- ▶ encode features
- ▶ choose a model
- ▶ assess model performance
- ▶ assess causality
- ▶ test whether decision support tool improves outcomes

Applications

- ▶ healthcare (e.g., identify risk factors for heart failure)
- ▶ finance (e.g., forecast stock prices)
- ▶ marketing (e.g., understand customer behavior)
- ▶ manufacturing (e.g., quality control)
- ▶ social science (e.g., understand voting patterns)
- ▶ natural sciences (e.g., analyze climate data)
- ▶ sports analytics (e.g., predict game outcomes)
- ▶ ...

Applications

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- ▶ finance (e.g., forecast stock prices)
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- ▶ social science (e.g., understand voting patterns)
- ▶ natural sciences (e.g., analyze climate data)
- ▶ sports analytics (e.g., predict game outcomes)
- ▶ ...

talk to your neighbor: what applications are you excited about?

Course topics

course website:

<https://github.com/stanford-mse-125/website-2023>

Course objectives (I)

- ▶ plot
- ▶ predict
- ▶ choose
- ▶ understand

Course objectives (II)

this course is about

- ▶ learning to ask the right questions
- ▶ learning to understand the answers

at the end of the course, you should know

- ▶ at least one method to solve any problem
- ▶ when **not** to trust your solution

Course objectives (II)

this course is about

- ▶ learning to ask the right questions
- ▶ learning to understand the answers

at the end of the course, you should know

- ▶ at least one method to solve any problem
- ▶ when **not** to trust your solution

the rest you can learn online. . .

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Tech stack

- ▶ In person or Zoom for lectures, section, and office hours
- ▶ Course website for course materials (syllabus, schedule, homework, project, etc)
- ▶ poll everywhere for polls polllev.com/madeleineudel1824
- ▶ Ed for Q&A and announcements
- ▶ Gradescope for quizzes, submitting homework, grades, solutions
- ▶ Github for warehousing code (demos, projects, and hw starter code)
- ▶ Google colab for developing code

Our programming language policy

- ▶ we'll do demos and provide homework starter code in python
- ▶ you're welcome to use any language you like (that your TAs can read) for homework or project
- ▶ TAs will only support python

Course requirements and grading

course website:

(grading, course requirements, lectures, homework, etc)

<https://github.com/stanford-mse-125/website-2023>

Course requirements and grading

Poll: should we allow chatGPT and friends

- ▶ on homework?
- ▶ on quizzes?

take home quizzes? how many quizzes?

Questions

during lecture:

- ▶ ask out loud

outside of lecture:

- ▶ ask at office hours
- ▶ ask on Ed
- ▶ don't send email

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