CSE 519: Data Science
Steven Skiena
Stony Brook University

Lecture 0: Course Administration

What is Data Science?

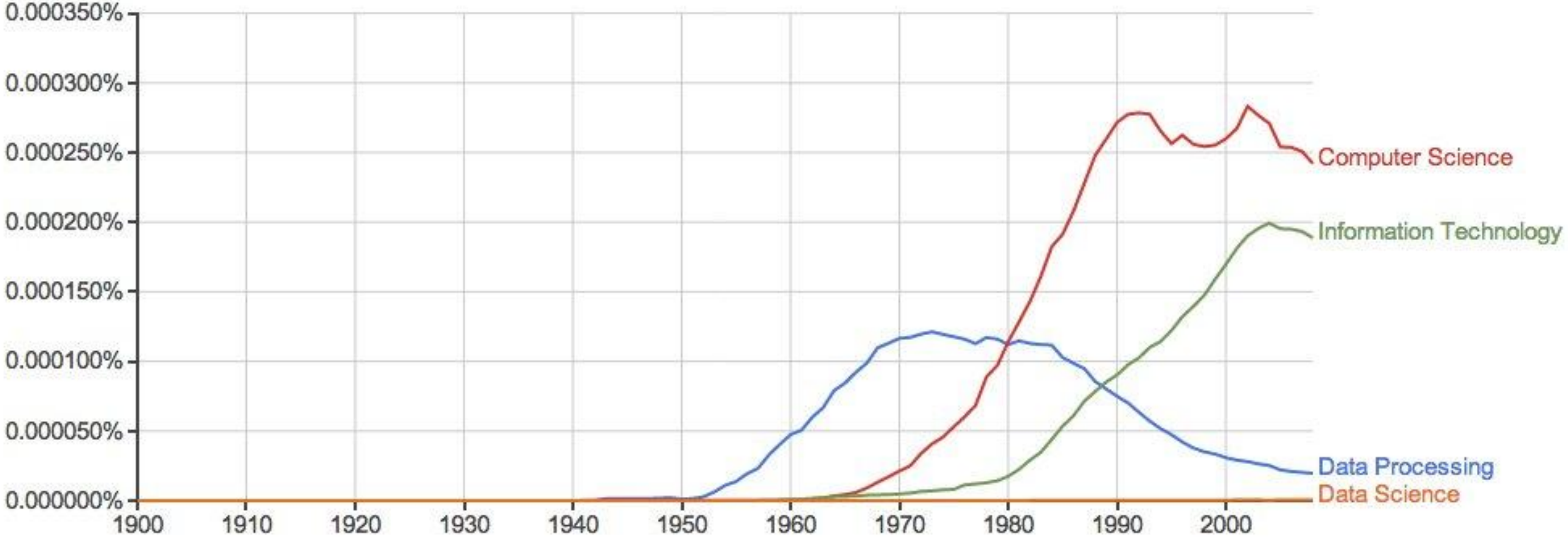
Like any emerging field, it isn’t yet well defined, but incorporates elements of:

- Exploratory Data Analysis and Visualization
- Machine Learning and Statistics
- High-Performance Computing technologies for dealing with scale.

Why Data Science?

- New technology makes it possible to capture vast amounts of logging / sensor data.
- Computing advances make it possible to analyze data on ever increasing scales.
- Prominent role models (Google, Moneyball, hedge funds, Nate Silver, ...) have proven the power of modern data analytics.

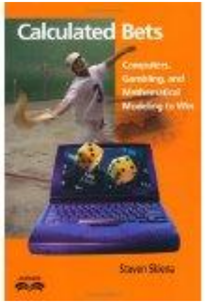
Data is not new to computing...

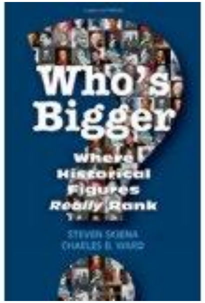


My Experience with Data

- Gambling systems in jai-alai and more
- Collaborations with biologists and social scientists
- Large-scale text analytics and NLP
- Startup companies
- Ranking historical figures

This drives what I will teach here.

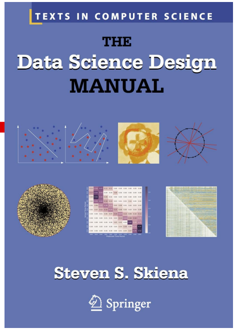




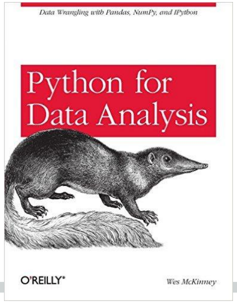
GENERAL SENTIMENT

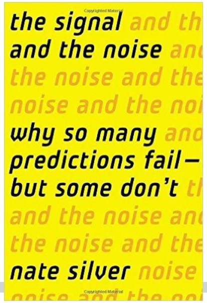
thrivemetrics

The Data Science Design Manual



- The course textbook is my new book, published by Springer-Verlag, 2017.
- Stuff from the book is fair for quizzes/exams.
- Recommended texts include Nate Silver's "The Signal and the Noise" and "Python for Data Analysis".





Semester Schedule (I)

8/28	L0: Course Introduction/Administration		
8/30	L1: Introduction to Data Science	1-26	(HW1 out)
9/4	L2: Mathematical Preliminaries	27-38	
9/6	L5: Correlation	39-56	(HW1 in / HW2 out)
9/11*	Python for Data Science I	PDFA	
9/13	L6: Assembling Data Sets	57-68	
9/18	L7: Data Cleaning	69-94	
9/20*	L3/4: Python for Data Science II	PFDA	
9/25	L8: Scores and Rankings I	95-103	(HW2 in / HW3 out)
9/27	L8: Scores and Rankings II	104-120	(Project out)
10/2*	L9: Statistical Distributions	121-134	
10/4*	L10: Statistical Significance	135-154	
10/9	Fall break (no classes)		
10/11	L11: Principles of Visualizing Data	155-169	
10/16	L12: Practice of Data Visualization	170-300	(HW3 in)
10/18	L13: Building Models	201-212	

Semester Schedule (II)

10/23	L14: Validating Models	213-236	(Project proposal in)
10/25	L15: Linear Algebra Review	237-266	
10/30	L16: Linear Regression	267-278	
11/1	L17: Gradient Descent Search/Regularization	279-288	
11/6	L18: Logistic Regression and Classification	289-302	
11/8	L19: Nearest Neighbor Methods I	303-319	
11/13	L19: Nearest Neighbor Methods II	320-329	
11/15	L20: Clustering	330-350	(Progress reports in)
11/20	L21: Introduction to Machine Learning I	351-362	
11/22	Thanksgiving (class cancelled)		
11/27	L21: Introduction to Machine Learning II	363-376	
11/29	L22: Topics in Machine Learning	377-390	
12/4	L23: Achieving Scale	391-418	
12/6	L24: Human-centric Data Science	419-426	(Final reports in)
12/12	Final exam (11:15AM-1:45PM)		

Course Project

- This will be a group project, where each team takes on a particular forecasting challenge and builds a predictive model.
- Each team will start from scratch, including finding/constructing the relevant data sets.
- There will be a *fixed* set of 5-7 choices of projects available.

Grading

- 45% of your grade will be from your group project, split between proposal, progress, and final reports, and peer grading.
- There will be a final exam worth 25% of the grade, and daily quizzes worth 10%.
- The remaining 20% comes from three HW assignments before the project.

Google Classroom / Piazza

The homework assignments, and projects will be submitted by Google Classroom, so sign up as in the syllabus.

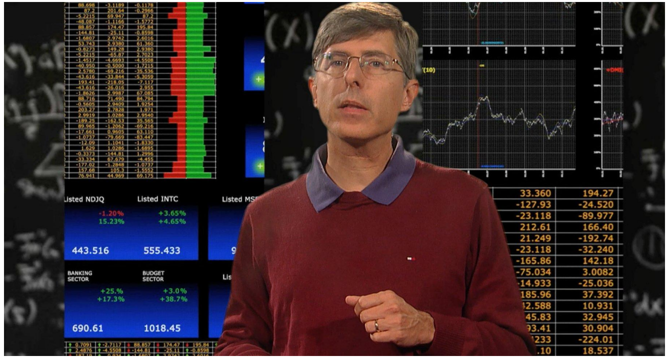
Daily quizzes are also in Google Classroom so come to class signed on.

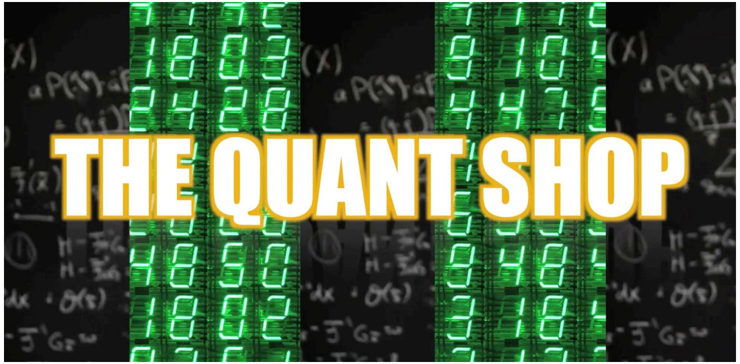
Discussions and messages are on Piazza.

Sign up for these before the next class!

Reality TV (www.quant-shop.com)

In Fall 2015, each group's course project was professionally edited for public viewing.





Quant Shop: Episodes

1. Finding Miss Universe
2. Modeling the Movies
3. Winning the Baby Pool
4. The Art of the Auction
5. White Christmas
6. Predicting the Playoffs
7. The Ghoul Pool
8. Playing the Market

The projects will be used as ongoing examples, so start watching at www.quant-shop.com.

Each program runs 30 minutes.

Registration Survey

- Fill out the course registration questionnaire, to help me finalize registration.
- *Be sure to put the form in the right pile!*
- I will fix registration decisions before the next class.
- Enrollment history: 32 in 2015, 50 in 2016, 105 in 2017, 250 in 2018.