

Introduction to Data Science



UNIVERSITY OF
SAN FRANCISCO

James D. Wilson

BSDS 100 - Intro to Data Science with R



Outline

- Course Overview
- What is Data Science?
 - Where is Data Science?
 - A brief history

Part I: Course Overview



A Little About Me

- Ph.D. Statistics and Operations Research (UNC Chapel Hill, '15)
 - Research focused on statistical analysis of networks
 - Explore, model, and analyze network data (e.g., social networks)
- M.S. Mathematical Sciences (Clemson University, '10)
- B.S. Mathematics and Chemistry (Campbell University '08)



A Little About Me

Classes I teach:

- BSDS 100 - Intro to Data Science with R
- MATH 106 - Business Statistics
- MATH 370 - Probability with Applications
- MATH 373 - Statistical Learning
- MSAN 601 - Linear Regression Analysis
- MSAN 630 - Advanced Computational Statistics
- MSAN 700 - Social Network Analysis



A Little About Me

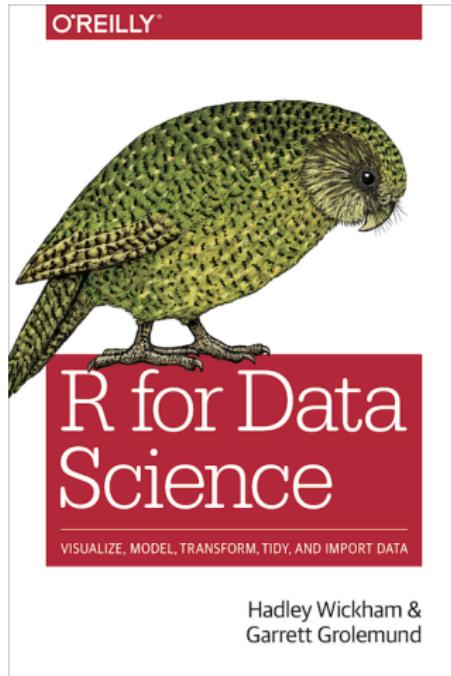
- Born and raised in NC (near Raleigh)
- Live in Rockridge, Berkeley.
- A huge college basketball fan! (Go Heels!)
- Have loved college football since 2008 (Go Tigers!)
- Enjoy tasting beers (bourbon-barrel stouts are my favorite).



Course Description and Syllabus

All lecture notes, the syllabus, assignments, and course description are available at this course website:

<https://github.com/jdwilson4/Intro-Data-Science-2017>



Available online here: <http://r4ds.had.co.nz/index.html>



Other Resources



The Best Place for Answers to R Questions?



Part II: What is Data Science?



What is Data Science?

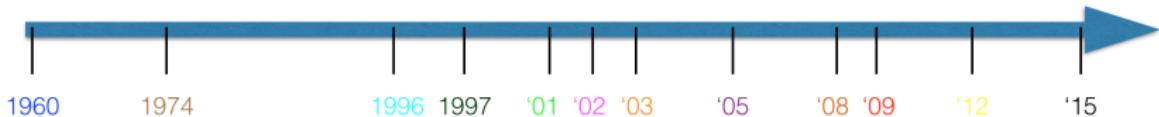
- **Wikipedia:** “the extraction of knowledge from data.”
- A precise definition is a bit unclear and has faced much controversy... (we'll see more on this in a moment)
- Practitioners tend to agree on the *components* of data science:
 - gathering and cleaning data
 - database management
 - exploratory analysis
 - predictive modeling
 - data summary and visualization

Where is Data Science?



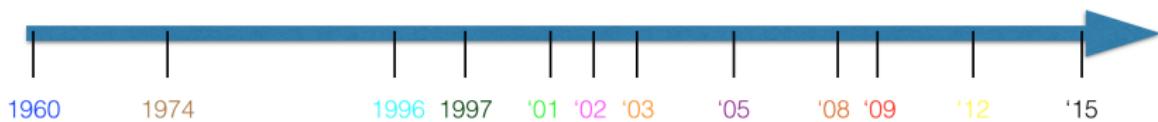
- Twitter feed, December 2014

The Evolution of Data Science



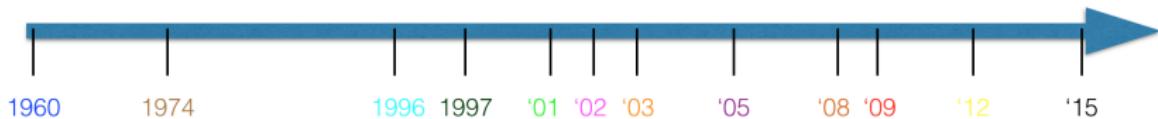
- 1960: Peter Naur (CS Ph.D.) published *Datalogy: the science of data and its place in education*.
- 1974: Peter Naur published *Concise Survey of Computer Methods*.
 - defines data science as “the science of dealing with data, once they have been established.”
 - continues to say that “... the relation of the data to what they represent is delegated to other fields and sciences.”

The Evolution of Data Science



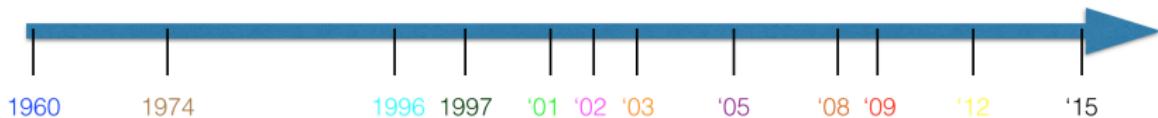
- 1996: International Federation of Classification Societies meet in Tokyo and for the first time include "data science" in the conference title: "Data science, classification, and related methods."
- 1997: C.F. Jeff Wu gave the inaugural lecture "Statistics = Data Science?" for appointment to the H. C. Carver Professorship at the University of Michigan.

The Evolution of Data Science



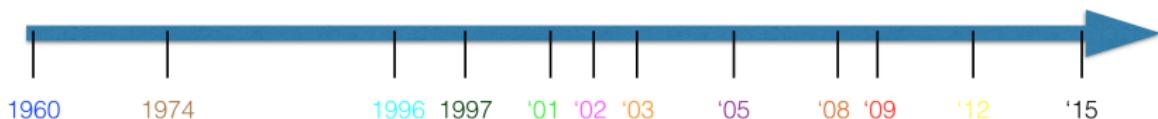
- **2001:** William Cleveland (Bell Labs) published *Data Science: An Action Plan for Expanding the Technical Areas of the Field of Statistics*.
 - Sets forth 6 areas for a university department involving statistics.
- **2002:** *Data Science Journal* is launched
 - Focus on data systems, publications on internet, and applications
- **2003:** *Journal of Data Science* is launched
 - Focus on application of statistical and quantitative methods

The Evolution of Data Science



- **2005:** National Science board redefines data scientists:
 - "The information and computer scientists, data and software programmers, disciplinary experts, ... who are crucial to successful management of a digital data collection whose primary activity is to conduct creative inquiry and analysis"
- **2008:** DJ Patil (LinkedIn) and Jeff Hammerbacher (Facebook) coined the term "data scientist" to define their jobs

The Evolution of Data Science



- **January, 2009:** Hal Varian (chief economist at Google) writes that "... the sexy job in the next 10 years will be statisticians."
- **October, 2012:** Harvard Business Review publishes "Data Scientist: The Sexiest Job of the 21st Century."
- **February 5th, 2015:** DJ Patil appointed as the first Chief Data Scientist in the White House.



Applications



Marketing analytics, sports analytics, biotechnology, social experiments, e-commerce, government analysis, ...

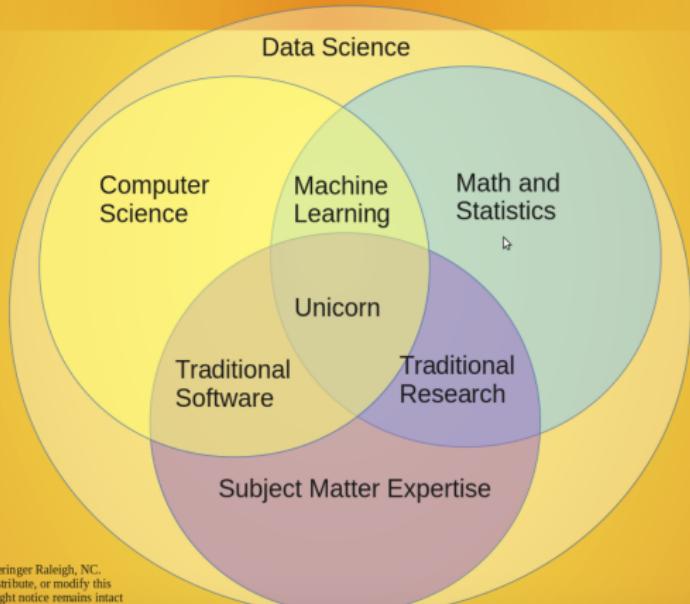


Why Data Science?

- Size, complexity, and amount of data
 - Predicted ≈ 40 trillion gigabytes of data in 2020; up from 130 billion in 2005!
 - **Big data** requires innovative techniques for analysis
- *McKinsey*: "The U.S. faces a shortage of 140K - 190K people with analytical expertise and 1.5 million managers and analysts with the skills to understand and make decisions based on the analysis of big data." (May, 2011)
- *Harvard Business Review*: "Data Scientist: The Sexiest Job of the 21st Century." (October, 2012)



Data Science Venn Diagram v2.0



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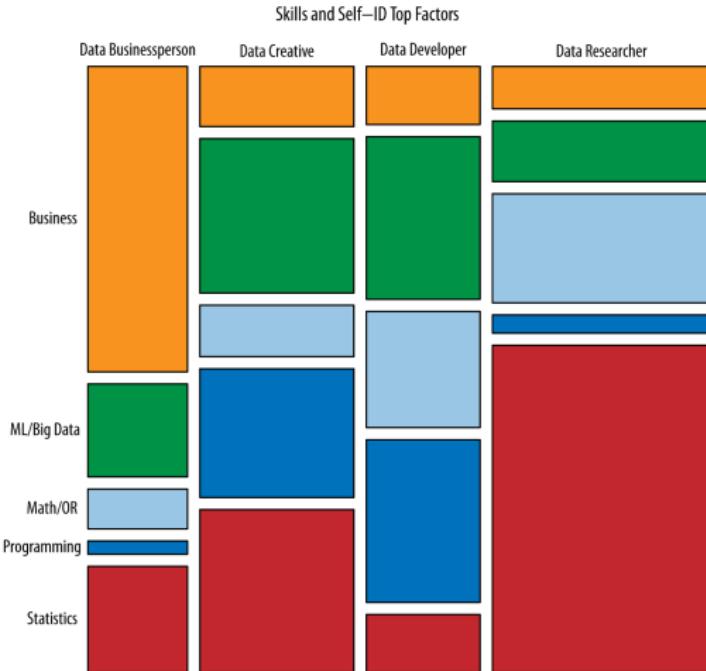
Data Scientists: The unicorn industries want?



- The field is inherently interdisciplinary
 - mathematical statistics
 - computer science
 - domain expertise
- The magical **Unicorn**: having all three skills
 - In 2014, these jobs go unfilled for 6 months or longer on average
- Has lead to the development of data science *teams*
 - hope is to merge skills of analysts

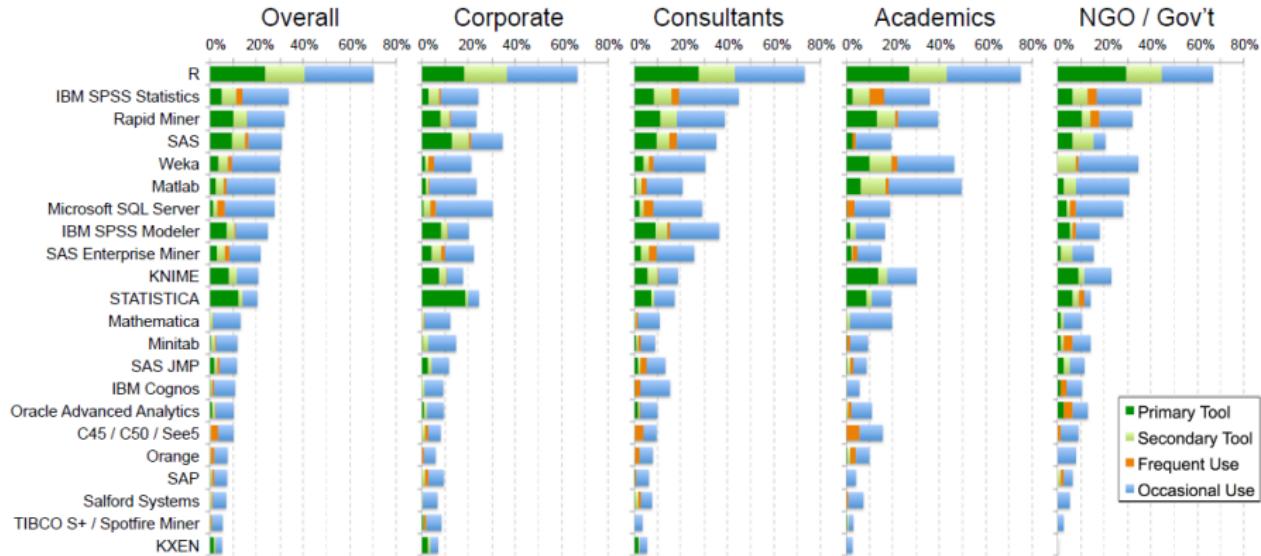


The Analysts of Data Science



"Analyzing the Analyzers (2013) by Harry, Murphy, and Vaisman."

Software: A Data Scientist's first weapon



-www.datasciencecentral.com



Data Science in Academia

[ABOUT USF](#) [DESTINATIONS](#) [GATEWAYS](#) [SEARCH](#)

USF College of Arts and Sciences

 THE MAJOR IN Data Science

ARTS AND SCIENCES
Undergrad Programs
Grad Programs
Prospective
Research & Creative Scholarship
Curricula
Study Abroad
Institutes & Centers
Dean's Welcome
Dean's Scholar Award
Lab Safety

Welcome
Get involved in the emerging Bachelor of Science degree in data University of San Francisco. This interdisciplinary major provides mathematics and quantitative skills problem solving for data-intensiv biology, computer science, and math.

The core courses in the BSOS major are in math units distributed among these two departments:

NYU
Master of Science in Data Science

PROGRAM OVERVIEW
Introduction to the MS in Data Science at NYU


SCHOOL OF INFORMATION STUDIES SYRACUSE UNIVERSITY

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Future Students

Undergraduate
Certificate of Advanced Study
CAS in Cultural Heritage Preservation

CAS in Data Science
Applied Data Science Open Online Course

CAS in e-Government Management and Leadership

CAS in Data Science

The Certificate of Advanced Study (CAS) in Data Science at the Syracuse University School of Information Studies (SISch) is a 15-credit graduate-level certificate designed for students currently pursuing another graduate degree or a post-baccalaureate work. Data Science focuses on teaching you specialists in data analysis, data storage and management, data visualization and general systems management, but the curriculum can be tailored to fit your education or career goals.

[Apply Now](#) [Application Checklist](#)

Available On-campus | Online | Full-time | Part-time

Data scientists are crucial to solving big data problems in areas such as medical research, defense intelligence, customer behavior, marketing, products, and business management. The CAS in Data Science at the School was the first New York State-approved certificate of its kind, and gives a competitive edge to students and professionals alike by equipping you with a mixture of the technical and theoretical skills. As the field grows, Data Science graduates are shaping the first wave of data science practices and

Berkeley School of Information

datascience@berkeley

Master of Information and Data Science
The UC Berkeley School of Information is about the only program in the country offering a Master of Information and Data Science online. Answer the questions below to learn more information.

NEXT STEP

Which best describes your background?

Home Page
What is Data Science
Academics
Admissions
F.A.Q.
Faculty
Resources

Graduate Analytics Program

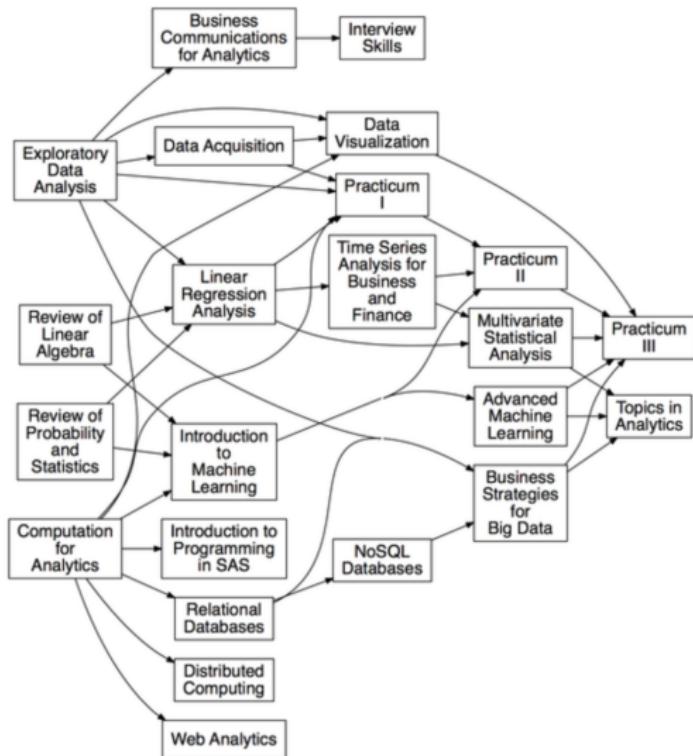
GEORGETOWN UNIVERSITY

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Master of Science in Analytics Concentration in Data Sciences (MS-DS Program)

UPCOMING EVENTS
No events found.

Academic Programs





A Data Scientist's Toolkit

Harvard's data science [toolkit](#):

- ① **Wrangle the data:** gather, clean, and sample data
- ② **Manage the data:** access big data quickly and reliably
- ③ **Explore the data:** to make a hypothesis
- ④ **Make predictions:** statistical methods
- ⑤ **Communicate the results:** visualization, presentations, summaries



Get Involved! Great Resources

- Flowingdata.com
 - Contemporary visualization and data manipulation techniques
- Kaggle.com
 - Kaggle competitions: win money for solving problems!
- Coursera.org
 - Free online courses in data science and machine learning
 - 972 courses. Great resource for coding, data analysis, etc.
 - Recent notable course: "The Data Scientist's Toolbox."