

“WHAT IS DATA SCIENCE?” RE-REVISITED

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Maybe pictures will help?

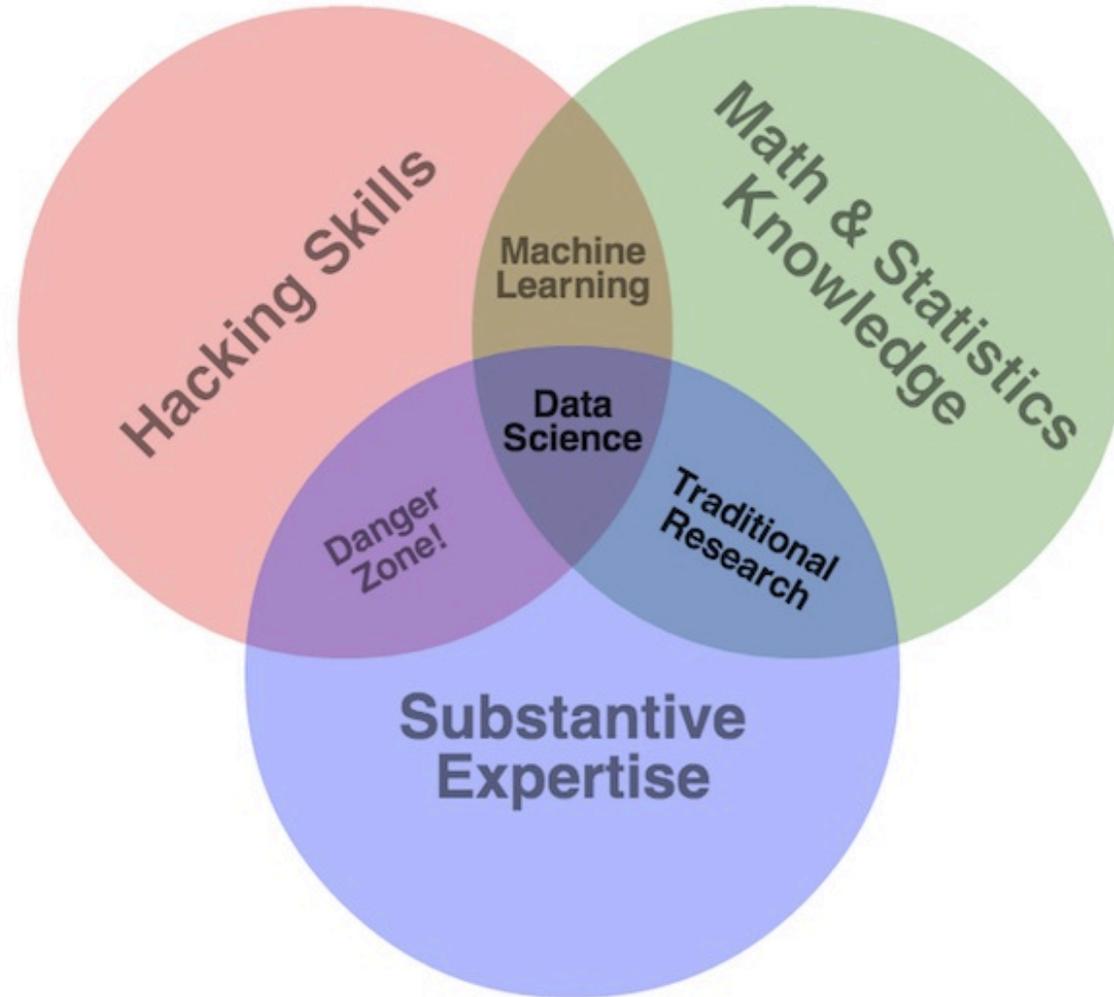


Image from Drew Conway

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MODERN DATA SCIENTIST

Data Scientist, the sexiest job of the 21st century, requires a mixture of multidisciplinary skills ranging from an intersection of mathematics, statistics, computer science, communication and business. Finding a data scientist is hard. Finding people who understand who a data scientist is, is equally hard. So here is a little cheat sheet on who the modern data scientist really is.

MATH & STATISTICS

- ☆ Machine learning
- ☆ Statistical modeling
- ☆ Experiment design
- ☆ Bayesian inference
- ☆ Supervised learning: decision trees, random forests, logistic regression
- ☆ Unsupervised learning: clustering, dimensionality reduction
- ☆ Optimization: gradient descent and variants

PROGRAMMING & DATABASE

- ☆ Computer science fundamentals
- ☆ Scripting language e.g. Python
- ☆ Statistical computing packages, e.g., R
- ☆ Databases: SQL and NoSQL
- ☆ Relational algebra
- ☆ Parallel databases and parallel query processing
- ☆ MapReduce concepts
- ☆ Hadoop and Hive/Pig
- ☆ Custom reducers
- ☆ Experience with xaaS like AWS



DOMAIN KNOWLEDGE & SOFT SKILLS

- ☆ Passionate about the business
- ☆ Curious about data
- ☆ Influence without authority
- ☆ Hacker mindset
- ☆ Problem solver
- ☆ Strategic, proactive, creative, innovative and collaborative

COMMUNICATION & VISUALIZATION

- ☆ Able to engage with senior management
- ☆ Story telling skills
- ☆ Translate data-driven insights into decisions and actions
- ☆ Visual art design
- ☆ R packages like ggplot or lattice
- ☆ Knowledge of any of visualization tools e.g. Flare, D3.js, Tableau

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Recurring themes

- You need “data skills”
 - Data wrangling
 - Reproducibility
 - Communication
 - Analytics and modeling
- You also need a mindset
 - Intellectual curiosity
 - Ability to solve problems
 - Interest in domain, even empathy with collaborators

For the purpose of this class:

Data science is the use of data to formulate and answer questions in a process that emphasizes clarity, reproducibility, and collaboration, and that recognizes code as a primary means of communication.

- We'll focus mostly on process; how to answer questions through analyses are the focus of other courses

Problem solving

“I’ve interviewed a lot of people over the years.... Recently, when people have an interview, I ask a single question that I think tries to get at the point of problem solving. The question I ask is along the lines of ‘[Imagine you had access to a database of 100 million mobile devices.] What questions would you ask? What types of things do you think you could learn, and how would you go about doing it?’”

Practice problem solving

- You can (and should) practice having a mindset, or a style of thinking
 - Make a habit of asking yourself what you would like to do with a data resource
 - Think about how you would accomplish it
- Be on the lookout for cool projects, and learn from them
 - Pay attention to the thought process, not just the specific tools
- Many projects need overlapping skill sets
 - You don't have to be a domain expert yourself, but you may need to work with one
 - You'll also have to communicate effectively with that person, which means at least taking an interest

How to learn data science

- Build a broad knowledge base
 - Don't be embarrassed by what you don't know
 - Corollary: don't be a jerk to people who don't know what you know
 - Ask questions (well) and keep learning
-
- Pretty much the same as learning anything, but hard because people don't like to show their code

How to learn data science

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“Sucking at something is the first step to becoming sorta good at something”

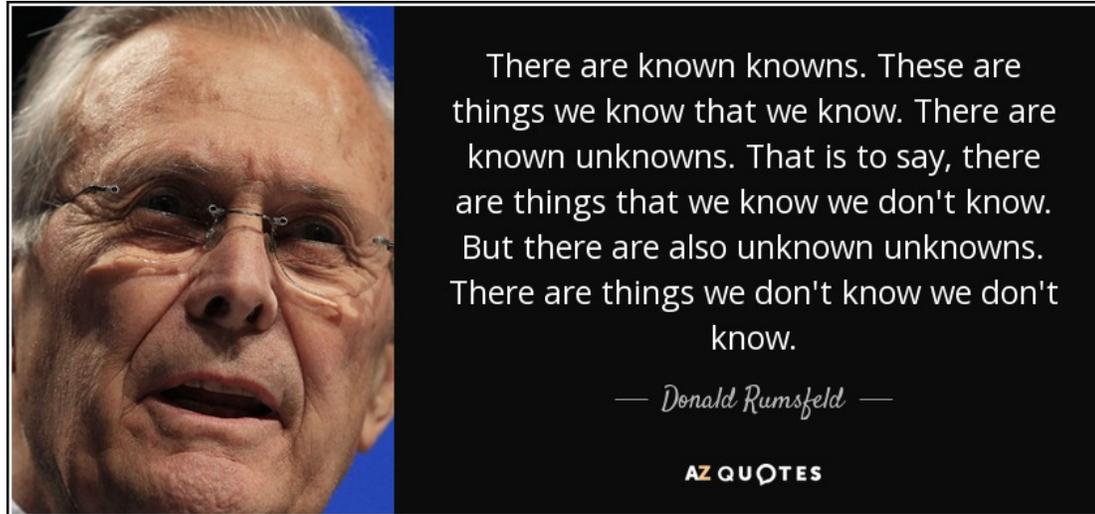
-Jake The Dog



don't like

How to learn data science

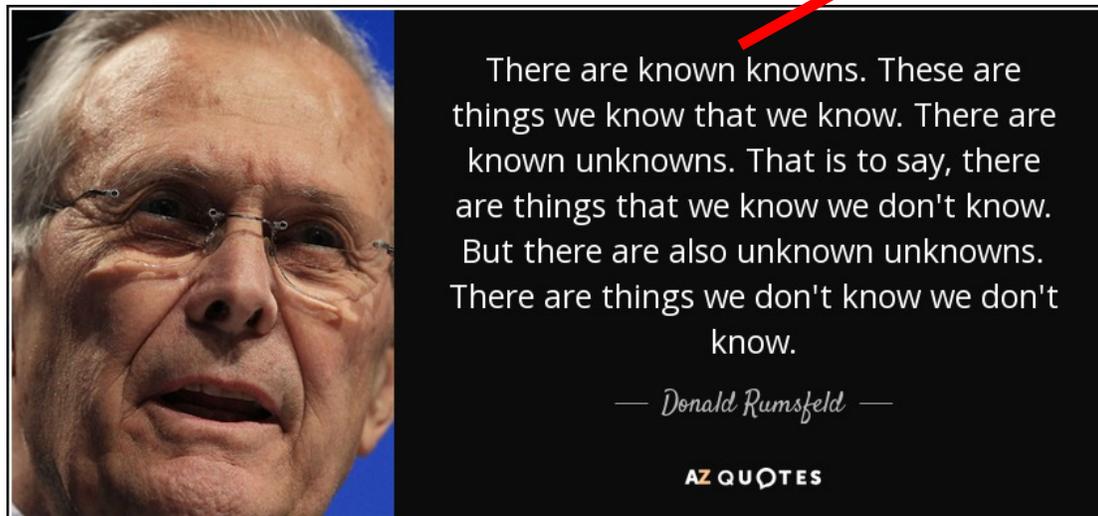
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How to learn data science

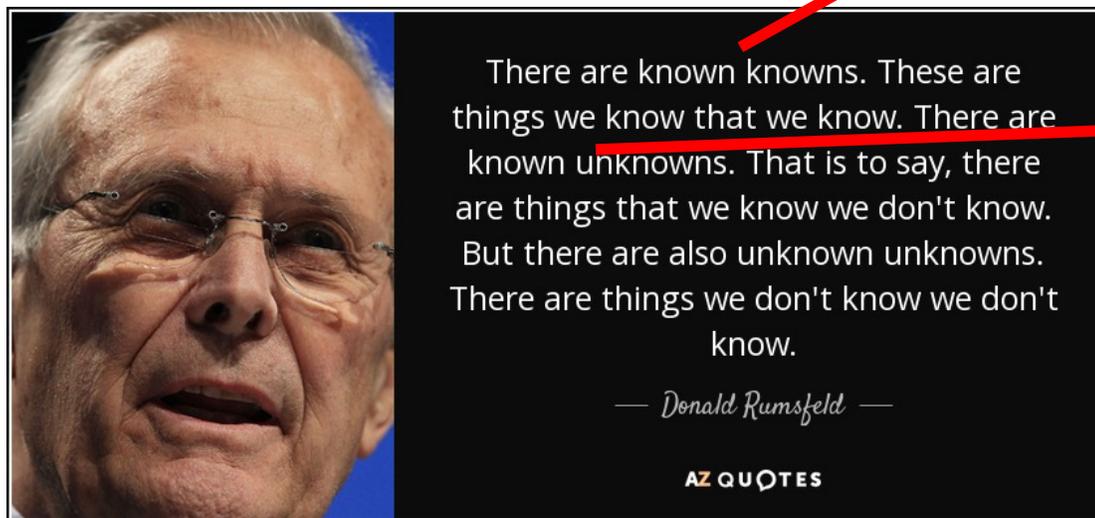
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Knowledge base! :-D



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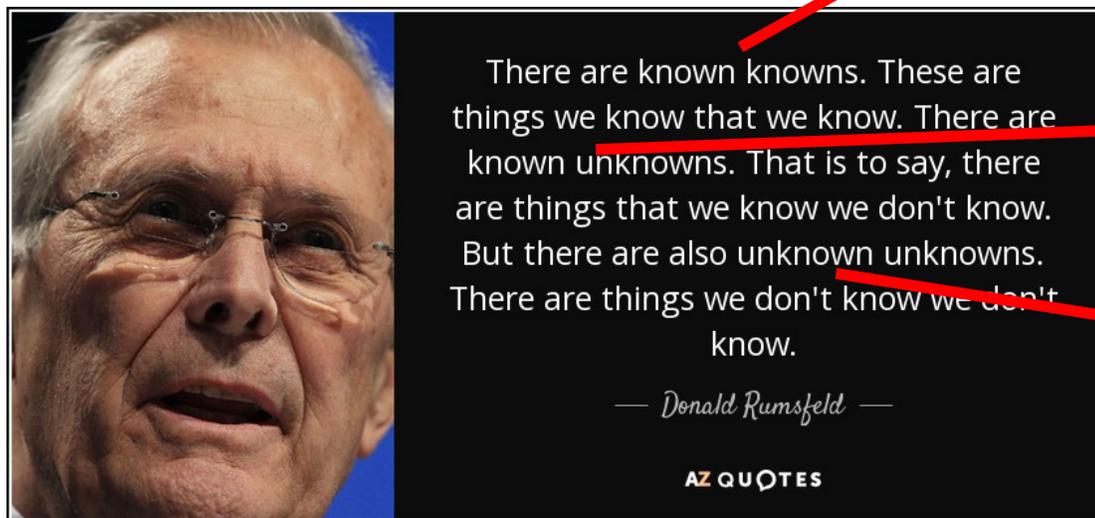


Knowledge base! :-D

Things you know exist and can learn how to do :-)

How to learn data science

- Be on the lookout for cool stuff!



Knowledge base! :-D

Things you know exist and can learn how to do :-)

Things you don't know exist and can't use :-)

Data as a resource

The world's most valuable resource is no longer oil, but data

The data economy demands a new approach to antitrust rules



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Is Data The New Oil? How One Startup Is Rescuing The World's Most Valuable Asset



A public health lens

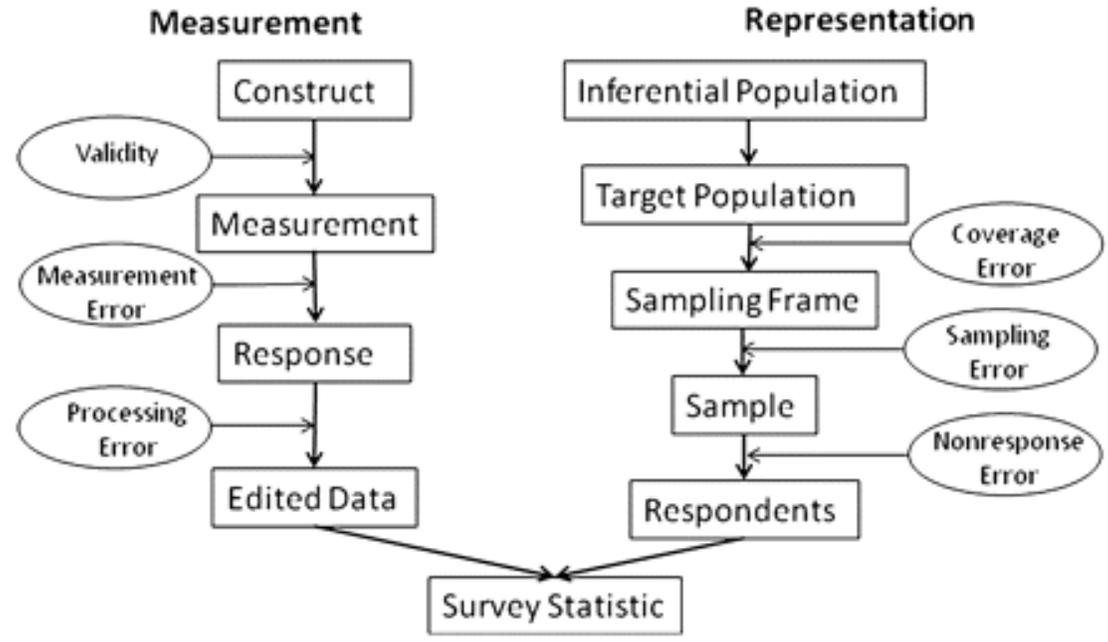
How can we use these data to improve health?

- Improve surveillance, leading to better prevention efforts?
- Better understanding of mechanisms?
- More precise and more effective outreach?

Limitations of big data

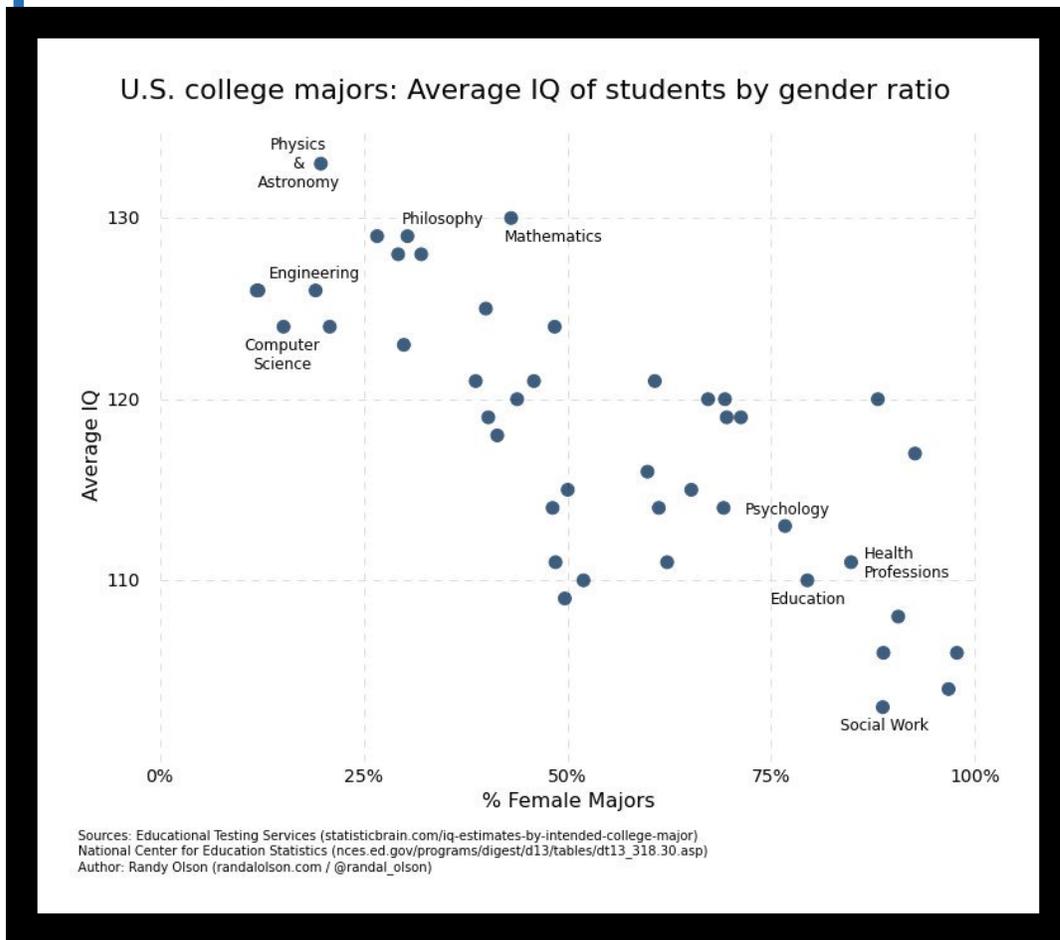
- Not trying to gang up on Google, Facebook and smartphone
 - In each case, these are smart people doing interesting thing with cool data
- These cases point to challenges to be overcome, and are important opportunities
 - How can public health practitioners engage with non-traditional partners in a beneficial way?
 - How can tech be used or evaluated as a public health tool when it changes so rapidly?
 - How can big data overcome issues of selection bias and access?

Be skeptical about data



From "Total Survey Error: Past, Present, and Future" (Groves and Lyberg)
via "Data Alone Isn't Ground Truth" by Angela Bassa

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Coverage Error

Sampling Error

Nonresponse Error

From "Total Survey Error: Past, Present, and Future" (Groves and Lyberg)
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Be skeptical

Untrustworthy Data Will Lead to Poor Conclusions

Trusting all data as if it were fact is a dangerous proposition.



So, can any data ever be trusted?

The short answer is... *it depends*. Skepticism is not a free pass to disregard data you disagree with. It's a tool to ensure that the conclusions derived from data are reliable and do, in fact, reflect reality.

You also shouldn't trust data just because it "proves" a point that you're already inclined to believe. It's probably even more important to be skeptical of extraordinary claims with which your heuristics already naturally align.

Sources: Ed
National Ce
Author: Ran

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A caveat before you leave ...

People sometimes confuse fancy methods for data science.

Don't Do That.

A simple method applied to good data and clearly communicated
is **much** better than
a fancy method that no one understands applied to bad data.

Final thoughts