DATA SCIENCE

Brian Chung

WHO ARE WE?

BRIAN CHUNG, INSTRUCTOR

Brian is a researcher in the field of quantitative finance. He has worked at Citadel, LLC researching trading signals and building prediction models.

He graduated with a BS in Electrical Engineering from University of Illinois-Urbana Champaign and an MS from Stanford University. When not in front of a computer, he enjoys motorcycling, CrossFit, and cooking with various gadgets.

WHO ARE WE?

SCOTT LITTLE, EXPERT IN RESIDENCE

Scott Little is a data scientist who likes working with physical sensor data. Recently, he completed a project that predicts solar power from satellite imagery and ground photometer sensors. He has a PhD in Physics from the University of Toledo, where he specialized in thin-film photovoltaic solar cells. For fun he enjoys cycling, dreaming, electronics, quadcopters, neurohacking and making things at Pumping Station: One, the local hackerspace.

WHO ARE YOU?

3 minutes:

‣ Turn to a person next to you and share your answers

‣ You will introduce them to the class ☺

Questions:

‣ What is your name?

‣ What industry do you work in or what field do you study?

‣ What are you most excited to learn in this class?

‣ What is a hobby or interest of yours?

AGENDA

‣ Logistics

‣ Course Philosophy

‣ What is Data Science?

‣ Machine Learning taxonomy

‣ Project Discussion

EXERCISE #1: BOOKMARK THIS PAGE

HTTPS://GITHUB.COM/BRIANCHANDBOUND/GA-DS

The course website has all the information regarding logistics. If you have a course question not answered, please email **gadschicago@gmail.com**

Website Topics:
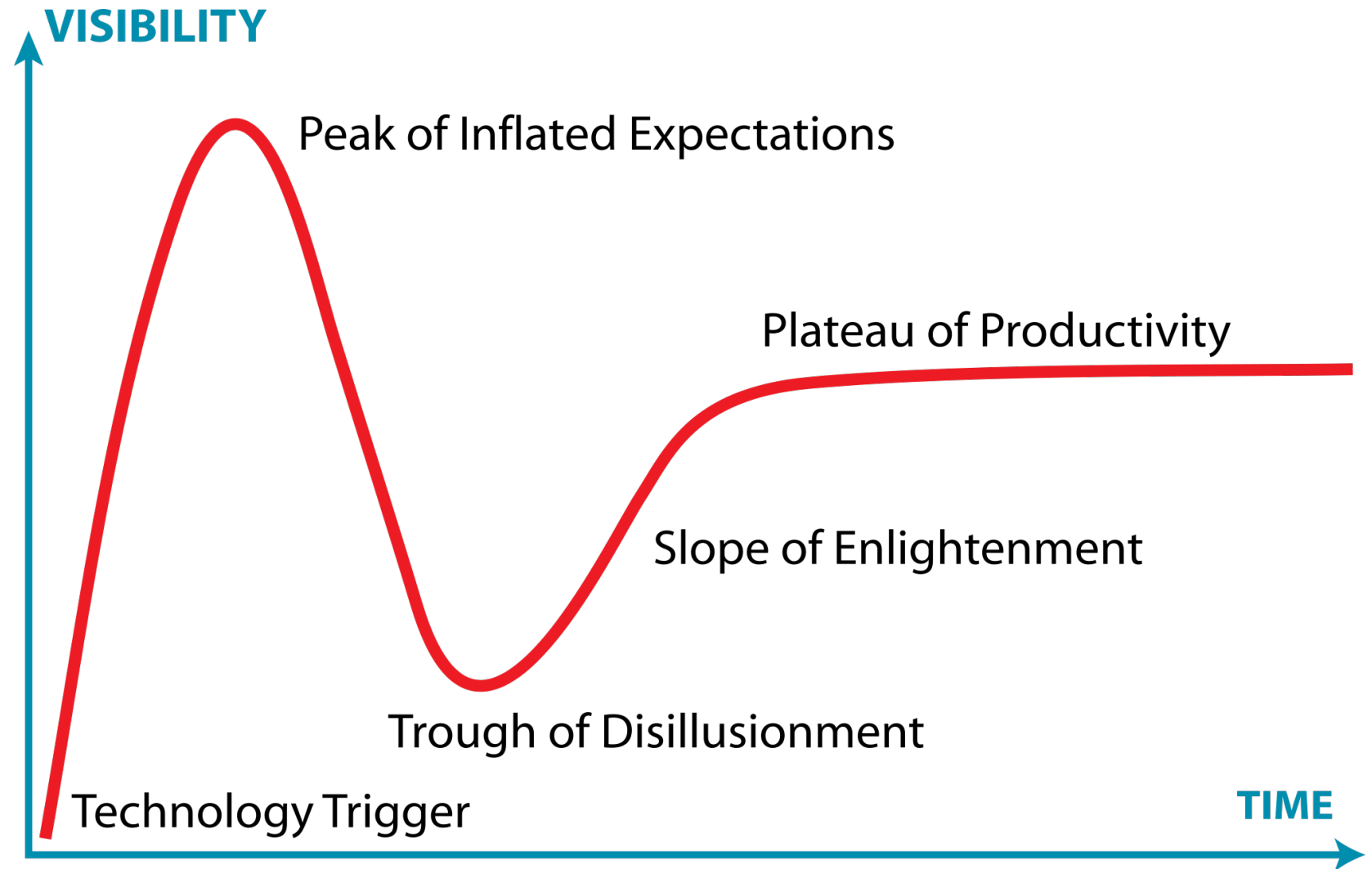**Course logistics**
Schedule
Project

COURSE PHILOSOPHY

THIS IS NOT THE END

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DATA SCIENCE IS HARD

Gartner Hype Cycle www.gartner.com

COURSE PHILOSOPHY

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VISIBILITY

I can solve world hunger with data science!

Learn all the things!

Starting to understand…

I know nothing, jon snow

Just signed up for data science

TIME
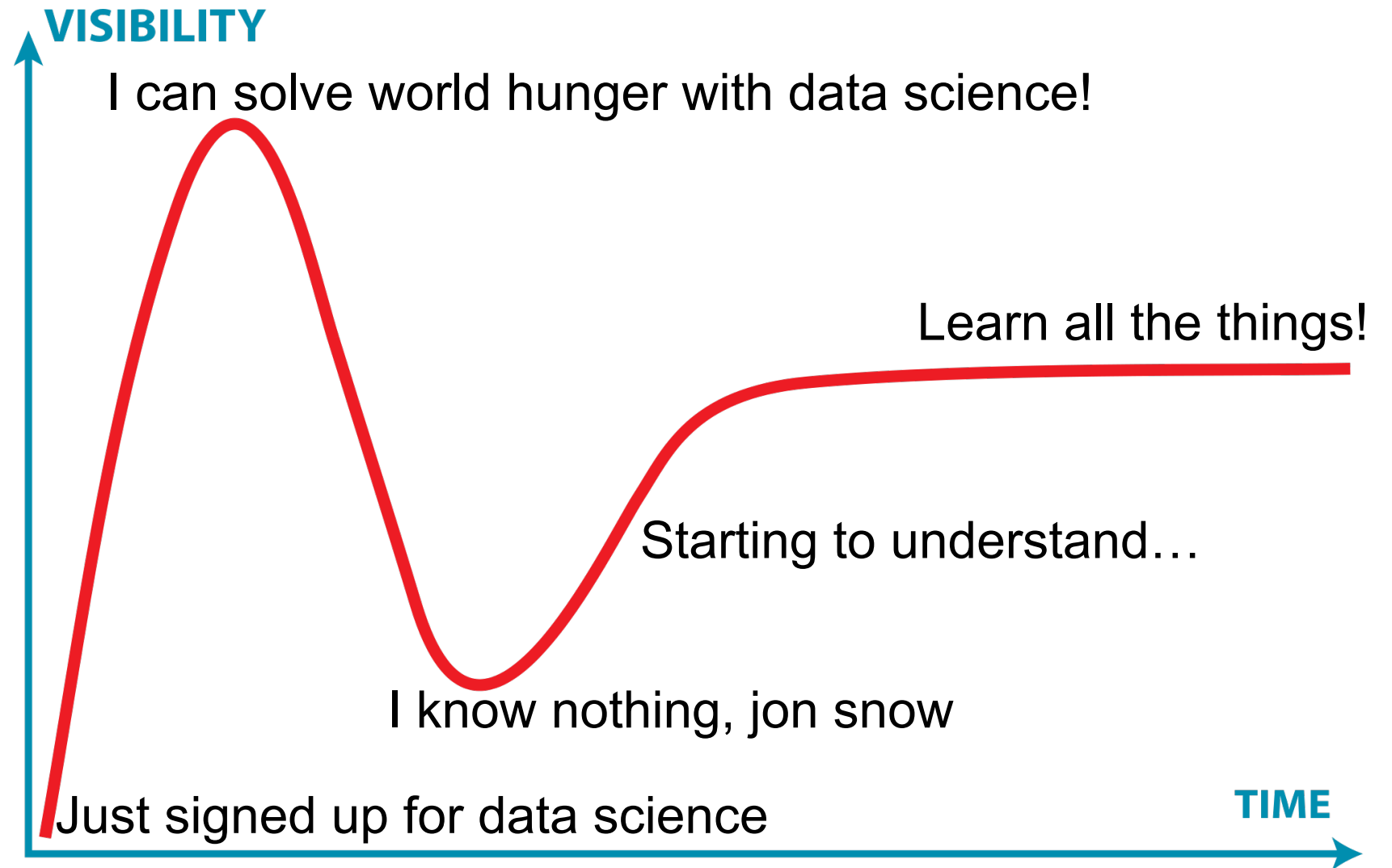
COURSE PHILOSOPHY

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DATA SCIENCE IS HARD

SEEK AND YE SHALL FIND (HELP)

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LEARN BY DOING

WHAT IS DATA SCIENCE?

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A set of tools and techniques used to extract useful information from data

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An interdisciplinary, problem-solving oriented subject

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A set of tools and techniques used to extract useful information from data

An interdisciplinary, problem-solving oriented subject

The application of statistical techniques to model practical problems

WHO USES DATA SCIENCE? TL;DR EVERYONE

WHAT QUALITIES MAKE UP A DATA SCIENTIST?

‣ Hacking skills

‣ Math and Stats knowledge

‣ Substantive expertise

WHAT QUALITIES MAKE UP A DATA SCIENTIST?

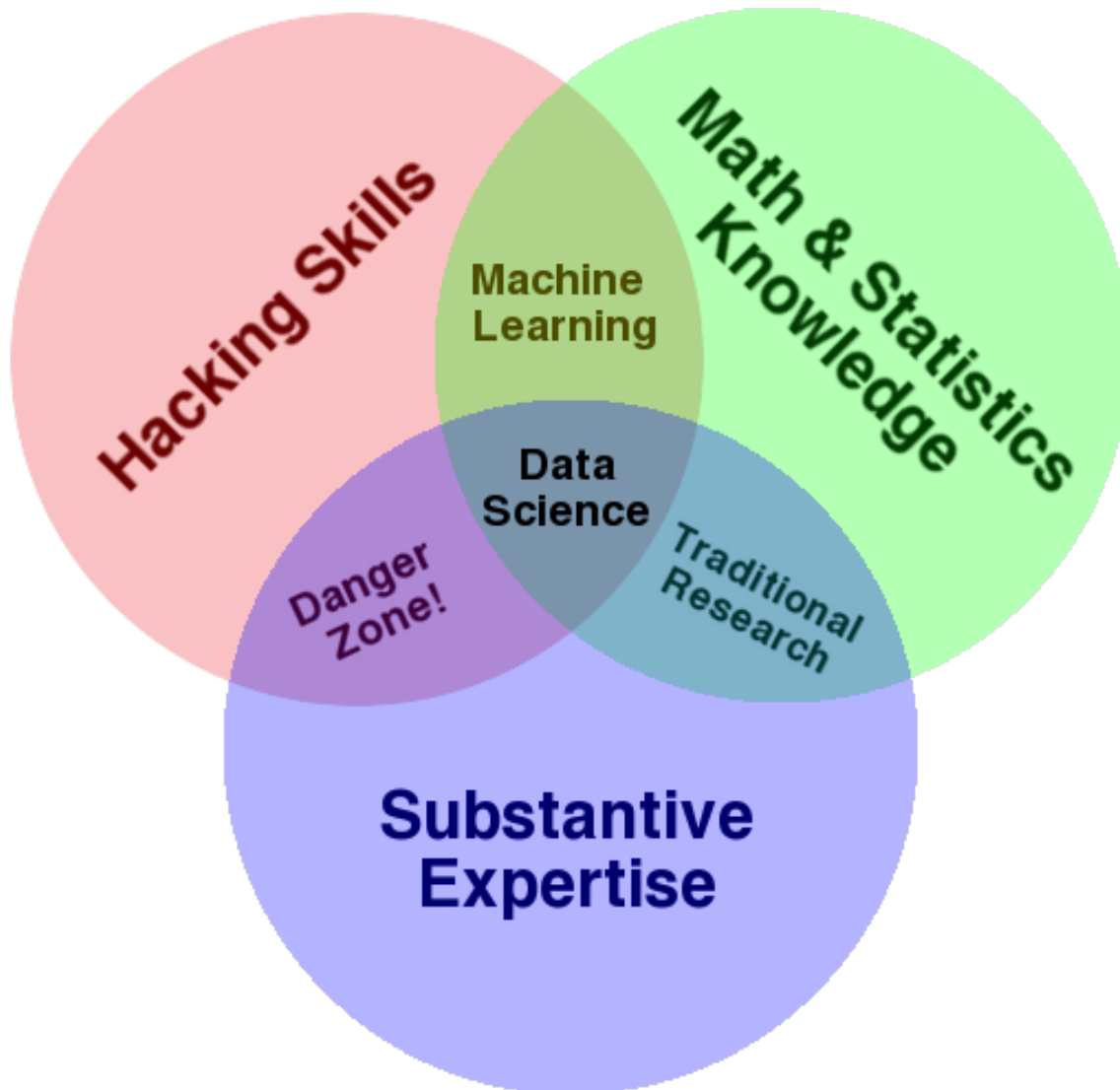Divorce rate in Maine correlates with Per capita consumption of margarine

Correlation: 99.26% (r=0.992558)

Margarine consumed ● Divorce rate in Maine
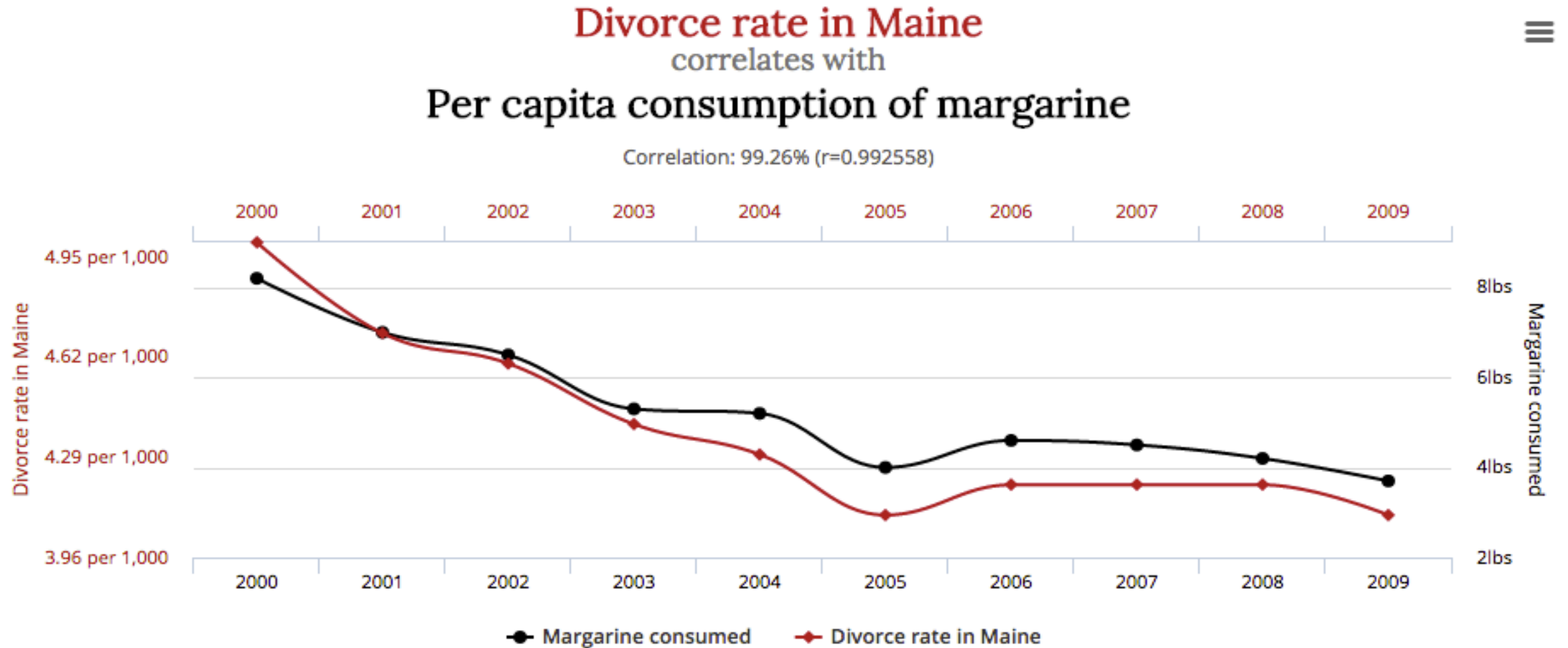
Data sources: National Vital Statistics Reports and U.S. Department of Agriculture
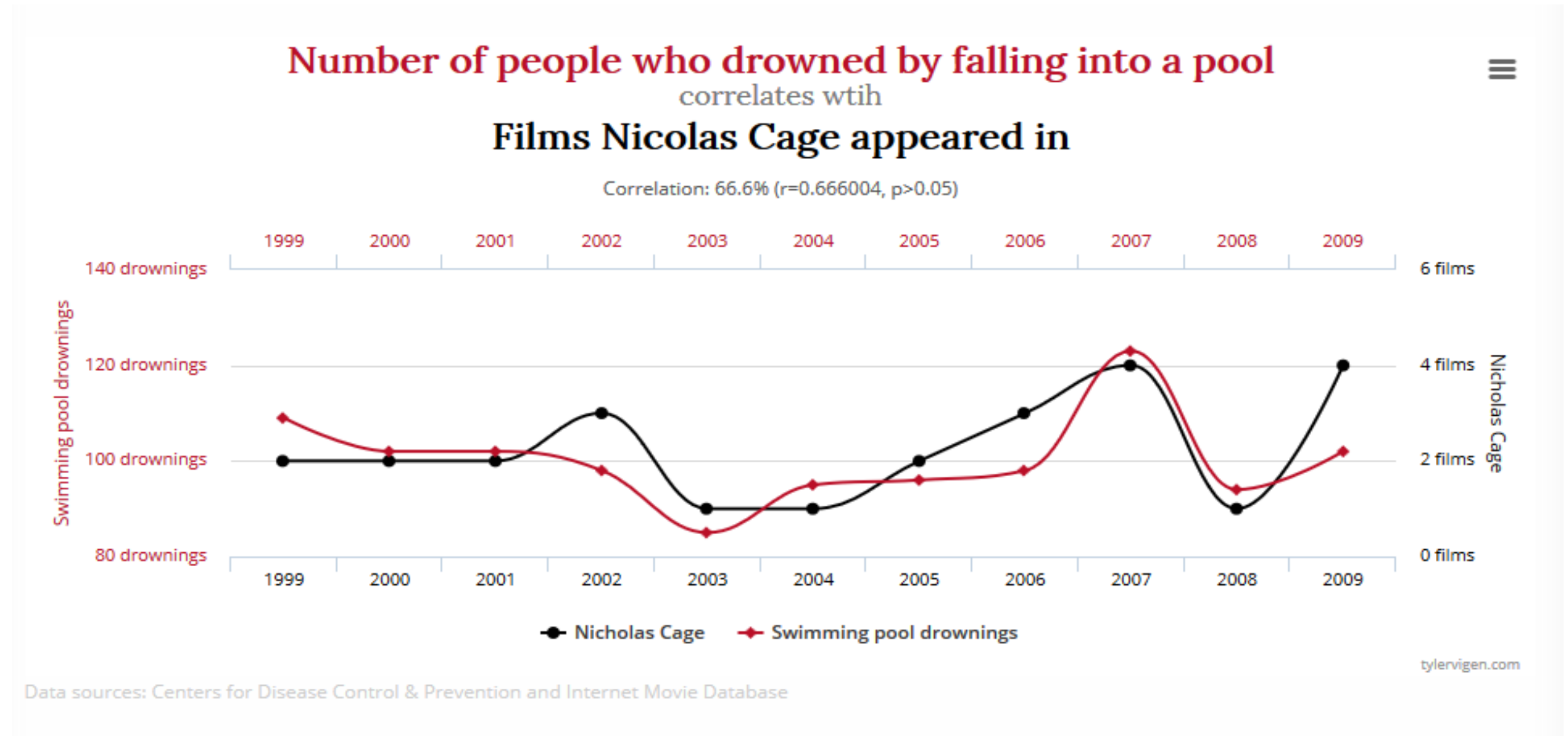
tylervigen.com

WHAT QUALITIES MAKE UP A DATA SCIENTIST?

Number of people who drowned by falling into a pool
correlates wtih
Films Nicolas Cage appeared in

Correlation: 66.6% (r=0.666004, p>0.05)

Data sources: Centers for Disease Control & Prevention and Internet Movie Database
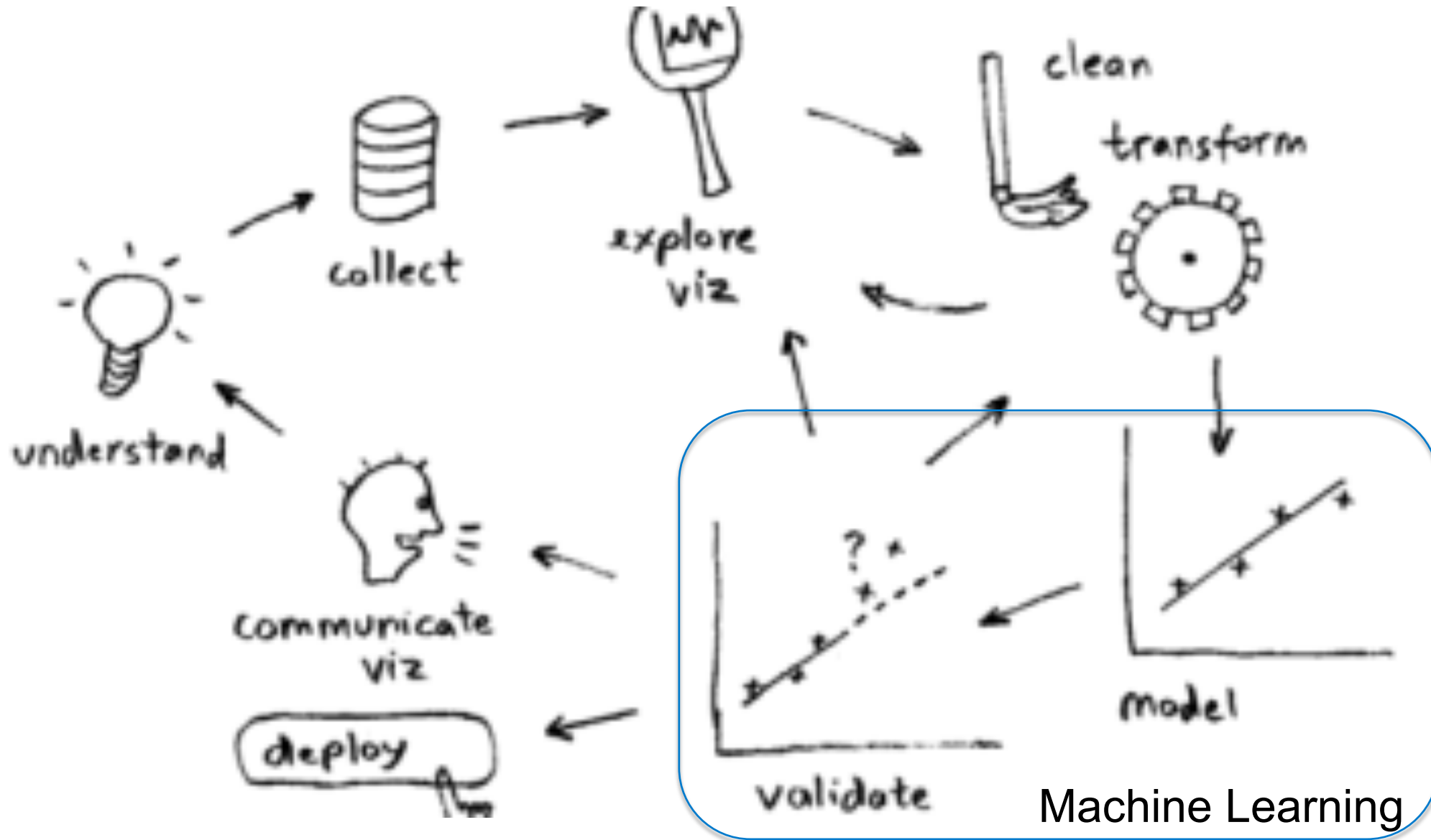
tylervigen.com

WHAT QUALITIES MAKE UP A DATA SCIENTIST?

- ‣ Hacking skills
- ‣ Math and Stats knowledge
- ‣ Substantive expertise

- ‣ Lastly…...Communication skills!

DATA SCIENCE WORKFLOW

collect

explore viz

clean transform

understand

communicate viz

deploy

validate

model

Machine Learning

DATA SCIENCE WORKFLOW EXAMPLE

PROBLEM: HOW MUCH SHOULD I CHARGE FOR A NEW CPU?

Understand: Can my previous CPU sales help predict future $ sales? I would like to predict $ Sales based on known quantities

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i.e. number of cores, clock speed, l1 and l2 cache sizes, number of competing chips, $ sales

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Validate: Does this model really work? For instance, let's try predicting sales on other previous chips. Does the model accurately predict the sales of those chips? If not, go back to the drawing board

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Communicate: Great! So the $Sales of a new CPU can be predicted based on a mixture of Gaussian variables based on logarithmic cpu clock speed, 10.45 * # of cores, (#Cores)^2, and exp(# of competing chips).

Now, how do you communicate this to a non-technical audience?

DATA SCIENCE WORKFLOW EXERCISE

PROBLEM: HOW WOULD YOU IMPLEMENT "MORE ITEMS TO CONSIDER" ON AMAZON.COM?

In a small group, define the process an Amazon Data Scientist would work through to curate the "More items to consider" list for a given user

MACHINE LEARNING

WHAT IS MACHINE LEARNING?

from Wikipedia:

Machine learning explores the study and construction of algorithms that can *learn from* and make predictions on data.

WHAT IS MACHINE LEARNING?

"A computer program is said to learn from experience **E** with respect to some set of tasks **T** and performance measure **P**, if its performance at tasks **T**, as measured by **P**, improves with experience **E**."

Tom Mitchell,
Professor CMU

WHAT IS MACHINE LEARNING?

"A computer program is said to learn from experience **E** with respect to some set of tasks **T** and performance measure **P**, if its performance at tasks **T**, as measured by **P**, improves with experience **E**."

"A student is said to learn from the General Assembly **Data Science Course** with respect to some set of **homeworks** and measured by **grades**, if its performance at **homeworks** as measured by **grades**, improves throughout the **course**"

WHAT IS MACHINE LEARNING?

from Wikipedia:

Machine learning explores the study and construction of algorithms that can *learn from* and make predictions on data.

"The core of machine learning deals with **representation** and **generalization**…"

Representation – extracting a mathematical structure from data

Generalization – making predictions from data

TAXONOMY OF MACHINE LEARNING PROBLEMS

Supervised   Labeled examples

Unsupervised   No labeled examples

TAXONOMY OF MACHINE LEARNING PROBLEMS

Supervised

Making Predictions (**generalization)**

Unsupervised

Discovering patterns (**representation**)
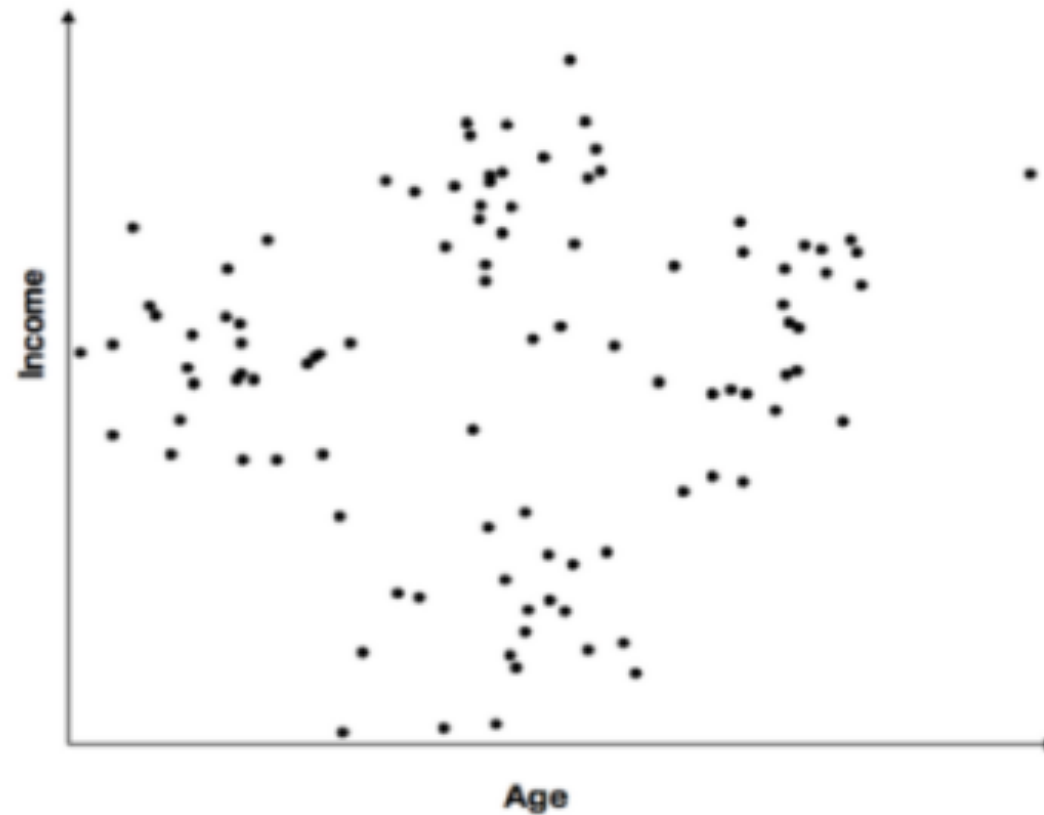
TAXONOMY OF MACHINE LEARNING PROBLEMS

Supervised Example

Jim is 30 years old and can eat 4 donuts. Sally can eat 2 donuts and is 60 years old. Bobby is 15 years old. How many donuts can he probably eat?
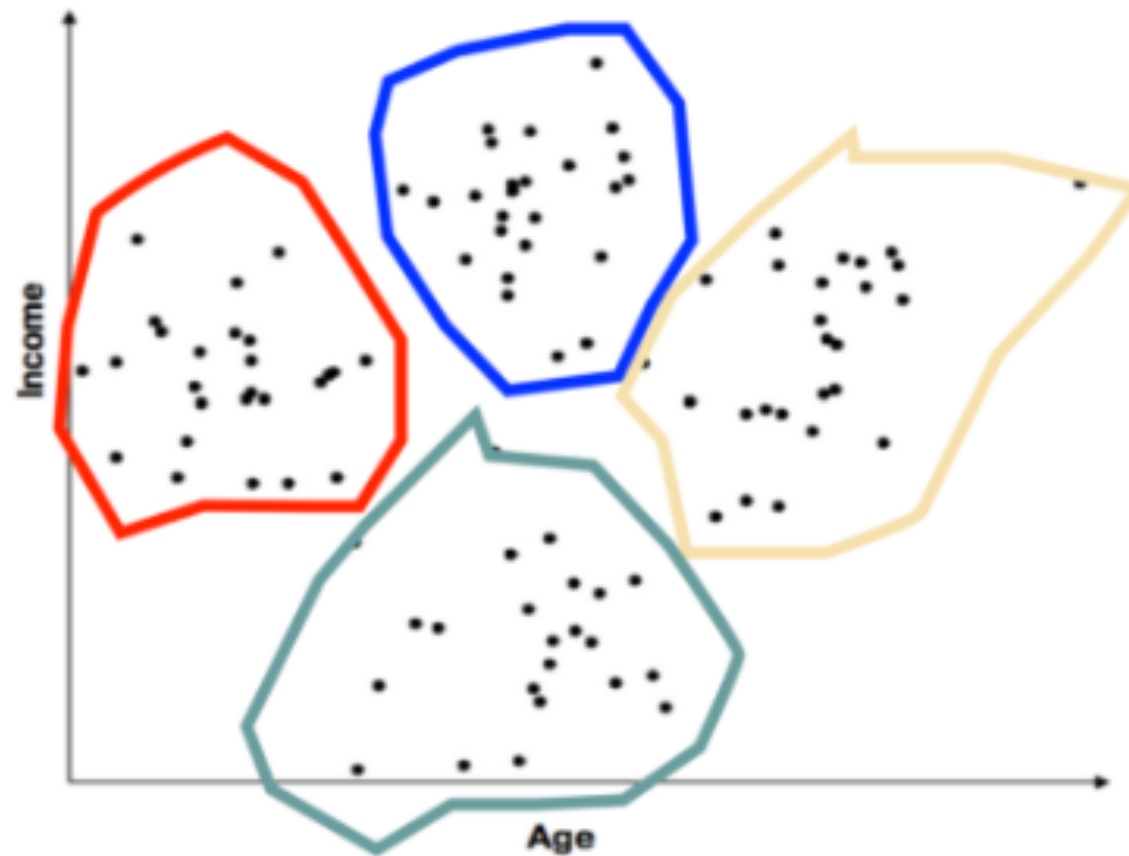
TAXONOMY OF MACHINE LEARNING PROBLEMS

Unsupervised Example

Can we find structure to unlabeled data?

TAXONOMY OF MACHINE LEARNING PROBLEMS

Unsupervised Example

TAXONOMY OF MACHINE LEARNING PROBLEMS

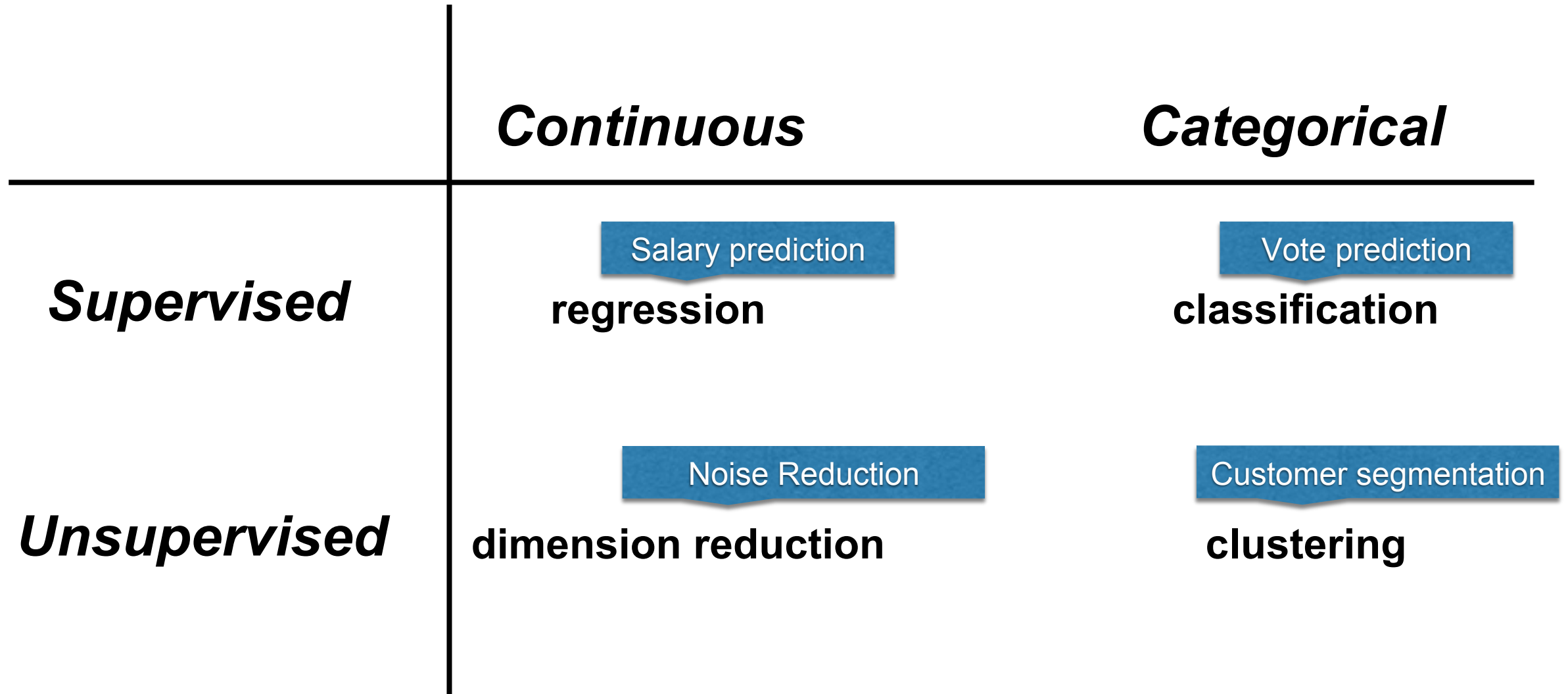|	*Continuous*	*Categorical*
	Quantitative (ordered data, age, Height, salary, etc.)	**Qualitative** (sets, yes/no, vote, etc.)

TAXONOMY OF MACHINE LEARNING PROBLEMS

	Continuous	*Categorical*
Supervised	regression	classification
Unsupervised	dimension reduction	clustering

TAXONOMY OF MACHINE LEARNING PROBLEMS

	Continuous	*Categorical*
Supervised	Salary prediction **regression**	Vote prediction classification
Unsupervised	Noise Reduction **dimension reduction**	Customer segmentation **clustering**

SUPERVISED OR UNSUPERVISED?

You want to determine whether an email is spam or not

SUPERVISED OR UNSUPERVISED?

You want to group Amazon customers together so you can advertise to them specifically

SUPERVISED OR UNSUPERVISED?

You want to predict the rating of a Netflix movie

SUPERVISED OR UNSUPERVISED EXERCISE

In a group, answer what kind of ML problems these can be classified as:
-Pandora Music Recommendation (i.e. What songs would you like)
-Digit recognition (i.e. post office performs digit recognition on mail)
-Predicting likelihood (i.e. probability) of a student passing high school
-You want to automatically reduce noise in your dataset
-You want to predict whether someone prefers Chevy or Ford based on their level of Car knowledge (1-10), age, and whether they like LS engines or Coyote engines

Homework 1 on Github – Due Dec 9 before class!