Closing Thoughts

Vishal Patel

Spring 2023

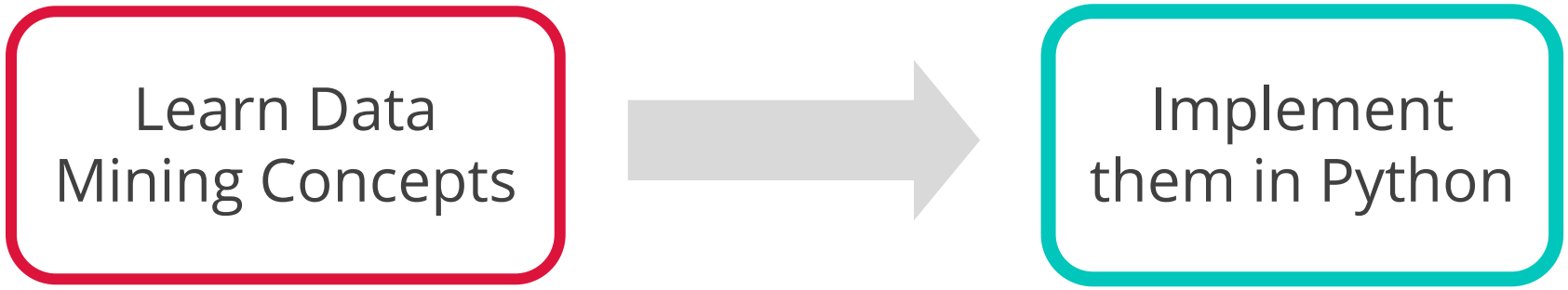
What We Covered

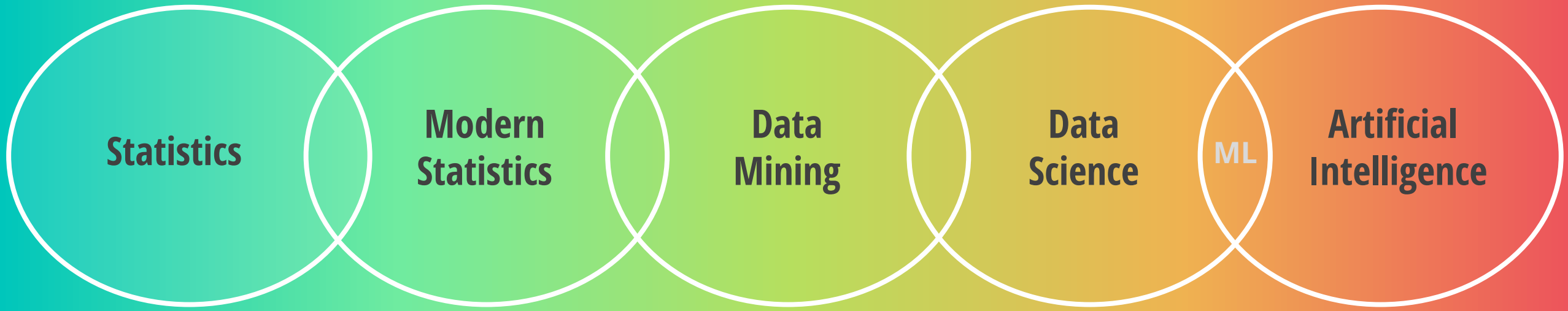
1. Introduction to Data Mining
2. The Data Science Process
3. Introduction to Regression
4. Linear Regression model
5. Build a model using partitioning
6. Decision trees
7. Classification Trees
8. Random Forests
9. Gradient Boosting Trees
10. Hyper-parameter optimization
11. Introduction to Neural Networks
12. Introduction to Clustering
13. Agglomerative Clustering
14. k-means Clustering
15. DBSCAN Clustering
16. PCA
17. Association Analysis (Apriori algorithm)
18. Collaborative Filtering
19. Data Wrangling

+ 20 Jupyter Notebooks

Education: What, when and why

Training: How





Regression
Correlation
Frequency analysis
Descriptive statistics
ANOVA

Normal distribution
t distribution
Random sampling
Design of Experiments
Bayesian statistics

Algorithms & Computation
Computer Science
Neural Networks
Decision trees
Genetic algorithms
Relational Databases

Gradient Boosting
Random Forests
Support Vector Machines
Recommender systems
Unstructured data
Open source
Big Data

Deep learning
Convolutional Neural Networks
Image classification
Speech recognition
Natural Language Processing
Computer vision

Prehistory – 18th Century | Late 19th / Early 20th Century | Mid-Late 20th Century | 21st Century

Calculations by hand → ***Distributed computing***

Evolution of techniques and technology

"Artificial intelligence is one of the most profound things we're working on as humanity. It is more profound than fire or electricity."

– Sundar Pichai

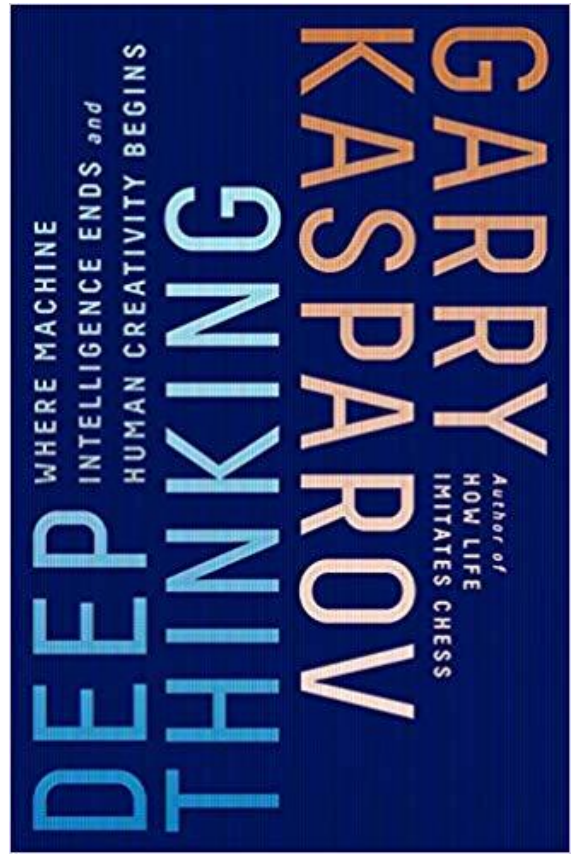
"With artificial intelligence we are **summoning the demon**."

– Elon Musk


Boston Dynamics


I, FOR ONE, WELCOME OUR
NEW AI OVERLORDS

Good riddance, you might imagine. But the worries about operator-less elevators were quite similar to the concerns we hear today about driverless cars. In fact, I learned something surprising when I was invited to speak to the Otis Elevator Company in Connecticut in 2006. The technology for automatic elevators had existed since 1900, but people were too uncomfortable to ride in one without an operator. It took the 1945 strike and a huge industry PR push to change people's minds, a process that is already repeating with driverless cars. The cycle of automation, fear, and eventual acceptance goes on.

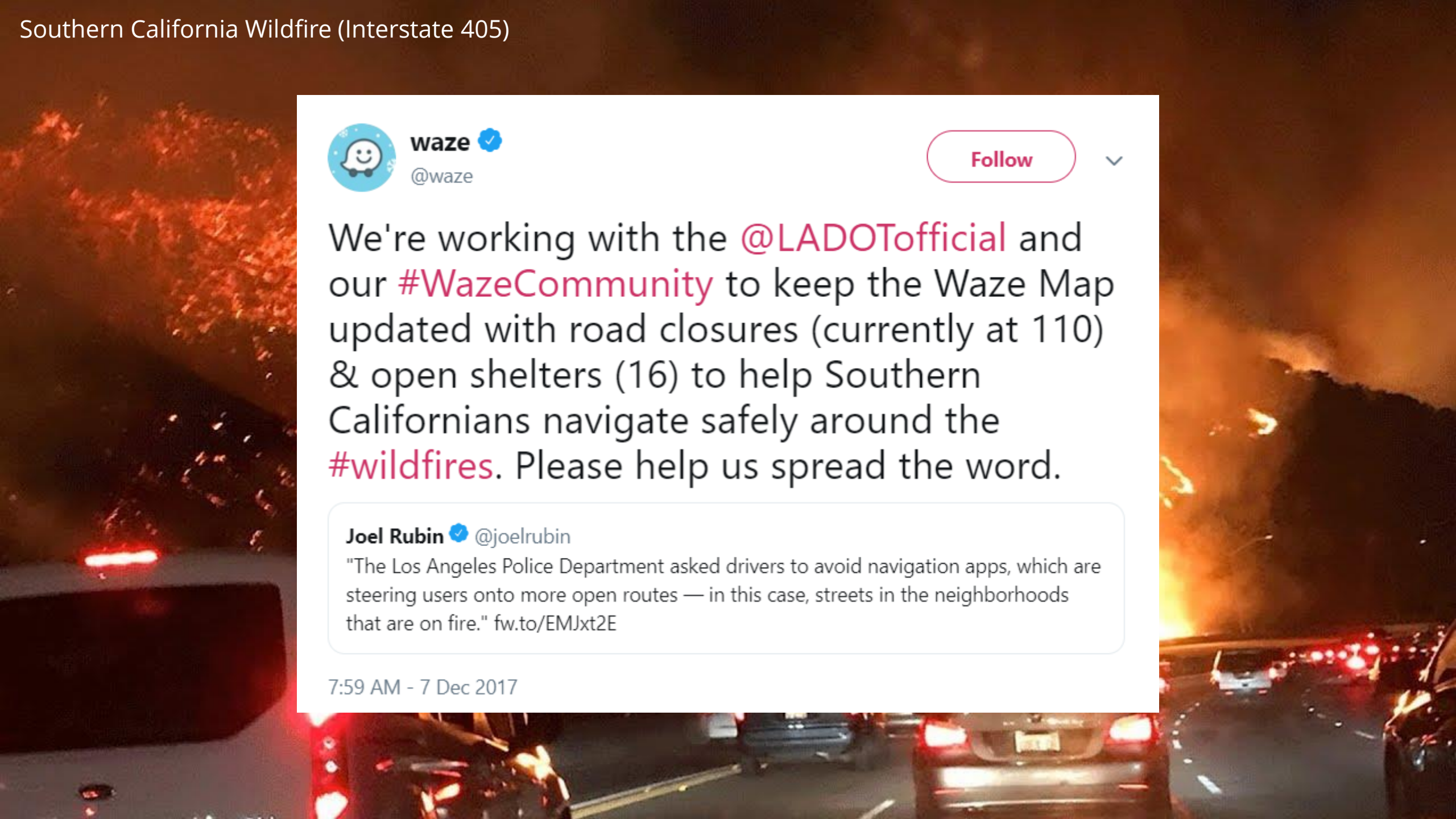


1. Jobs
2. Ethics

The number of people one farmer could feed

Museum of Bread Culture, Germany

Southern California Wildfire (Interstate 405)



waze
@waze

Follow

We're working with the @LADOTofficial and our #WazeCommunity to keep the Waze Map updated with road closures (currently at 110) & open shelters (16) to help Southern Californians navigate safely around the #wildfires. Please help us spread the word.

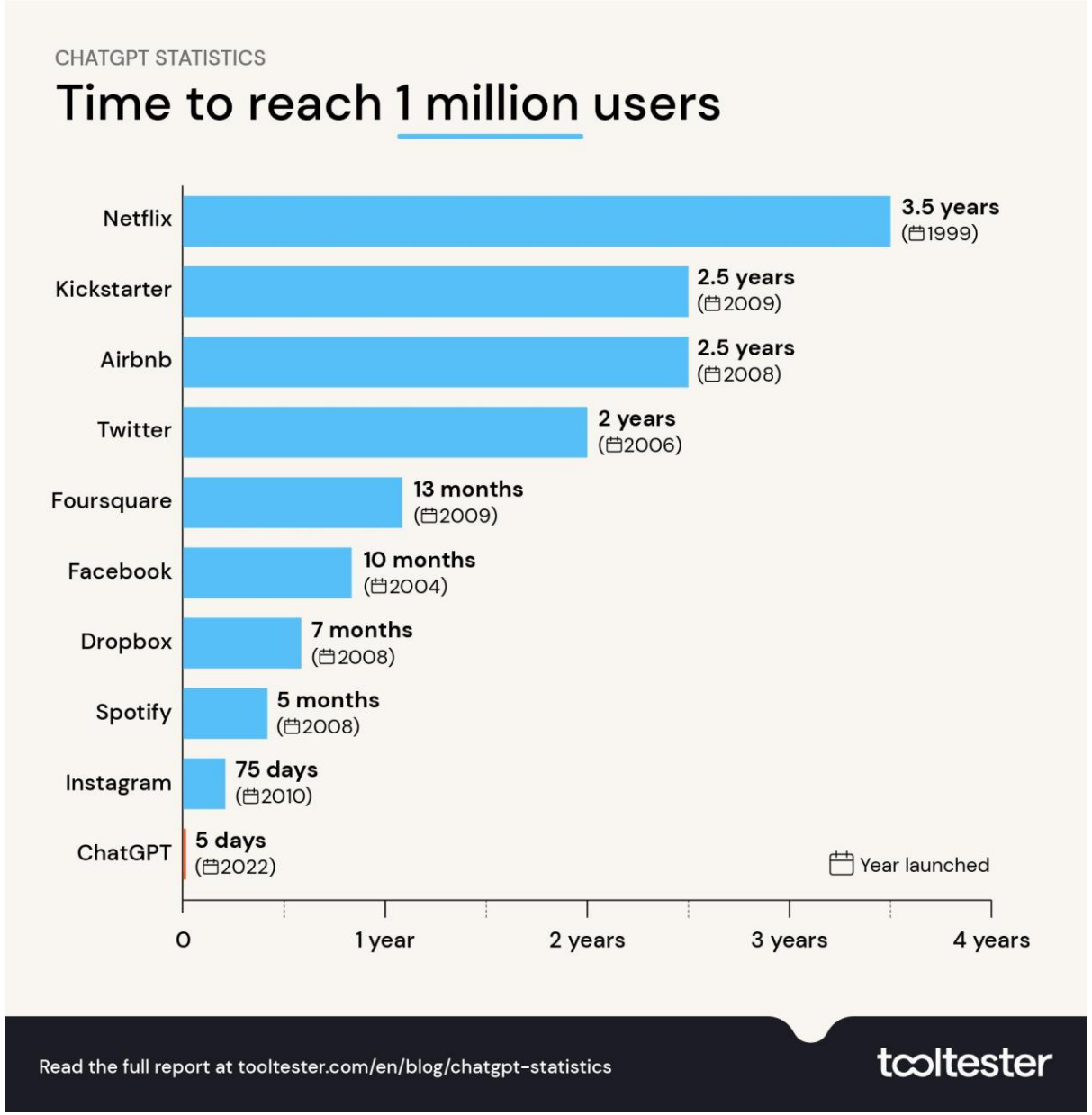
> **Joel Rubin** @joelrubin
> "The Los Angeles Police Department asked drivers to avoid navigation apps, which are steering users onto more open routes — in this case, streets in the neighborhoods that are on fire." fw.to/EMJxt2E

7:59 AM - 7 Dec 2017

Tay was an artificial intelligence chatbot that was originally released by Microsoft Corporation via Twitter on March 23, 2016.

It caused subsequent controversy when the bot began to post inflammatory and offensive tweets through its Twitter account, forcing Microsoft to shut down the service only 16 hours after its launch.

It was soon replaced with **Zo** [2016-2019].



- The fastest-growing user-base in the history of web apps: 1 million users in just five days!
- An average of **13 million daily visitors** in Jan 2023
- It is estimated that GPT-4 is trained on **100 trillion parameters**. (For comparison, a human brain has approximately 100 billion neurons and 100 trillion connections.)

GPTs are GPTs: An Early Look at the Labor Market Impact Potential of Large Language Models

Tyna Eloundou[1], Sam Manning[1,2], Pamela Mishkin*[1], and Daniel Rock[3]

[1]OpenAI
[2]OpenResearch
[3]University of Pennsylvania

March 20, 2023

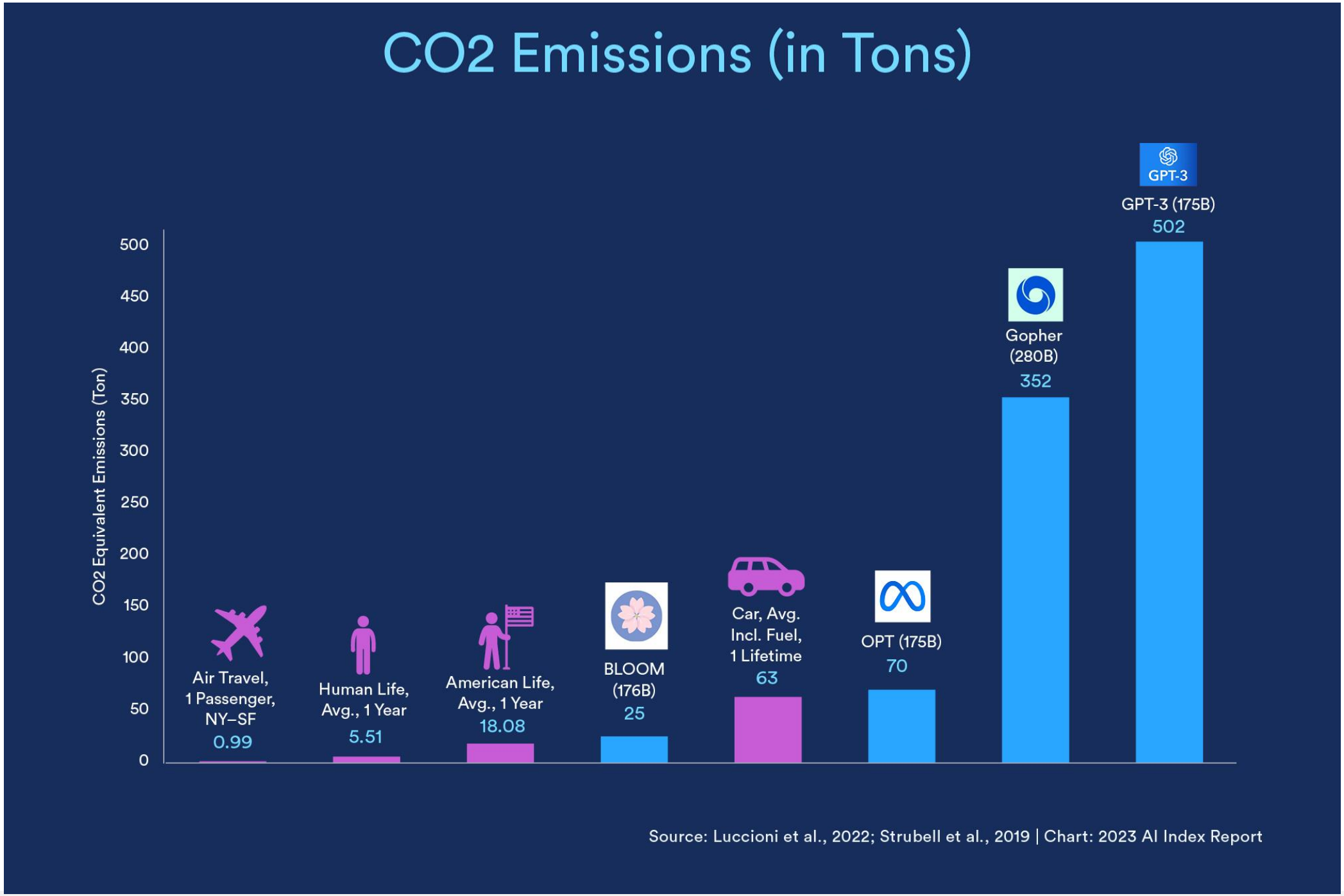
Abstract

We investigate the potential implications of Generative Pre-trained Transformer (GPT) models and related technologies on the U.S. labor market. Using a new rubric, we assess occupations based on their correspondence with GPT capabilities, incorporating both human expertise and classifications from GPT-4. Our findings indicate that approximately 80% of the U.S. workforce could have at least 10% of their work tasks affected by the introduction of GPTs, while around 19% of workers may see at least 50% of their tasks impacted. The influence spans all wage levels, with higher-income jobs potentially facing greater exposure. Notably, the impact is not limited to industries with higher recent productivity growth. We conclude that Generative Pre-trained Transformers exhibit characteristics of general-purpose technologies (GPTs), suggesting that as these models could have notable economic, social, and policy implications.

F Occupations Without Any Exposed Tasks

Occupations with no labeled exposed tasks
Agricultural Equipment Operators
Athletes and Sports Competitors
Automotive Glass Installers and Repairers
Bus and Truck Mechanics and Diesel Engine Specialists
Cement Masons and Concrete Finishers
Cooks, Short Order
Cutters and Trimmers, Hand
Derrick Operators, Oil and Gas
Dining Room and Cafeteria Attendants and Bartender Helpers
Dishwashers
Dredge Operators
Electrical Power-Line Installers and Repairers
Excavating and Loading Machine and Dragline Operators, Surface Mining
Floor Layers, Except Carpet, Wood, and Hard Tiles
Foundry Mold and Coremakers
Helpers–Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters
Helpers–Carpenters
Helpers–Painters, Paperhangers, Plasterers, and Stucco Masons
Helpers–Pipelayers, Plumbers, Pipefitters, and Steamfitters
Helpers–Roofers
Meat, Poultry, and Fish Cutters and Trimmers
Motorcycle Mechanics
Paving, Surfacing, and Tamping Equipment Operators
Pile Driver Operators
Pourers and Casters, Metal
Rail-Track Laying and Maintenance Equipment Operators
Refractory Materials Repairers, Except Brickmasons
Roof Bolters, Mining
Roustabouts, Oil and Gas
Slaughterers and Meat Packers
Stonemasons
Tapers
Tire Repairers and Changers
Wellhead Pumpers

Table 12: All 34 occupations for which none of our measures labeled any tasks as exposed.


CO2 Emissions (in Tons)
CO2 Equivalent Emissions (Ton)
500
450
400
350
300
250
200
150
100
50
0
Air Travel, 1 Passenger, NY–SF
0.99
Human Life, Avg., 1 Year
5.51
American Life, Avg., 1 Year
18.08
BLOOM (176B)
25
Car, Avg. Incl. Fuel, 1 Lifetime
63
OPT (175B)
70
Gopher (280B)
352
GPT-3
GPT-3 (175B)
502
Source: Luccioni et al., 2022; Strubell et al., 2019 | Chart: 2023 AI Index Report

Automated Inference on Criminality using Face Images

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(a) Three samples in criminal ID photo set S_c.

(b) Three samples in non-criminal ID photo set S_n

"[T]he authors find that their algorithm can classify **criminal faces** with **90% accuracy.**"

(a) Three samples in criminal ID photo set S_c.

(b) Three samples in non-criminal ID photo set S_n

Facial featurespurportedly associated with criminality, from Wu and Zhang (2016)

Smile detector!

"[The] algorithm finds that criminals have shorter distances between the inner corners of the eyes, smaller angles between the nose and the corners of the mouth and higher curvature to the upper lip"

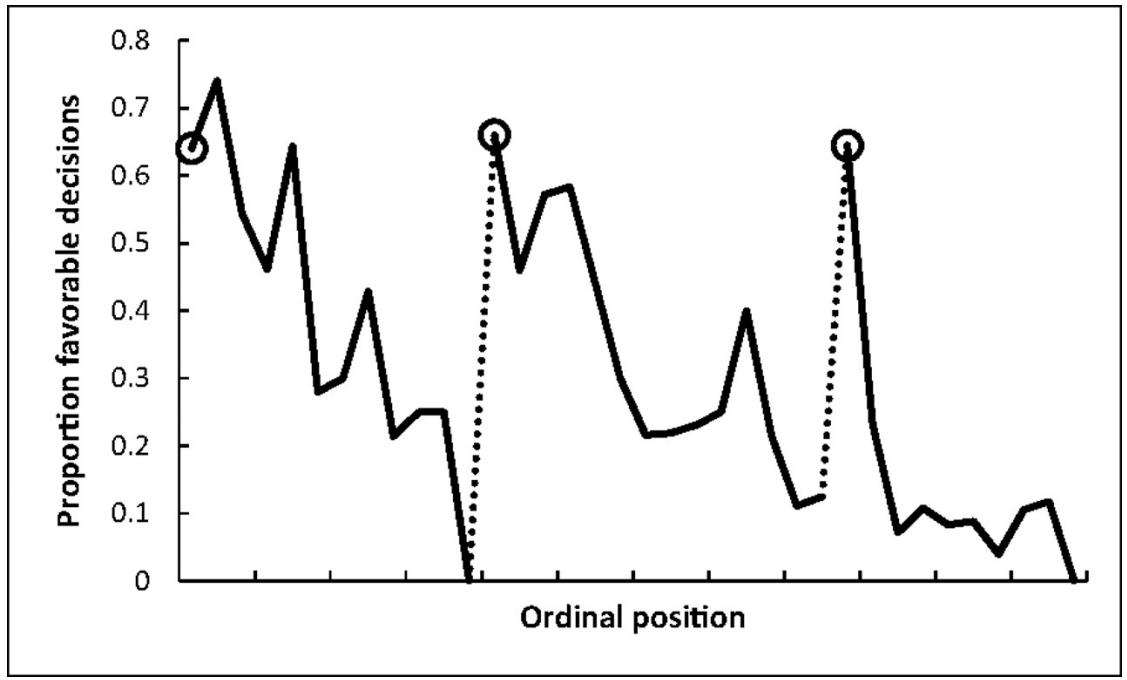
RESEARCH ARTICLE | SOCIAL SCIENCES |

Extraneous factors in judicial decisions

Shai Danziger, Jonathan Levav, and Liora Avnaim-Pesso Authors Info & Affiliations

Edited* by Daniel Kahneman, Princeton University, Princeton, NJ, and approved February 25, 2011 (received for review December 8, 2010)

April 11, 2011 | 108 (17) 6889-6892 | https://doi.org/10.1073/pnas.1018033108



The authors of the peer-reviewed paper looked at more than 1,000 rulings made in 2009 by eight judges. They found that the likelihood of a favorable ruling peaked at the beginning of the day, steadily declining over time from a probability of about 65% to nearly zero, before spiking back up to about 65% after a break for a meal or snack.

Social and Economical Bias

1. Errors (and biases) propagate quickly
2. Far reaching consequences
3. ‘Bias’ is not just a technical issues, it’s a **socio-technical** issue
4. There’s no silver bullet-solution
    1. What do we mean by “bias”?
    2. Who gets to decide what’s fair?

The Trouble with Bias - NIPS 2017 Keynote - Kate Crawford (YouTube)

Numbers don’t lie!!

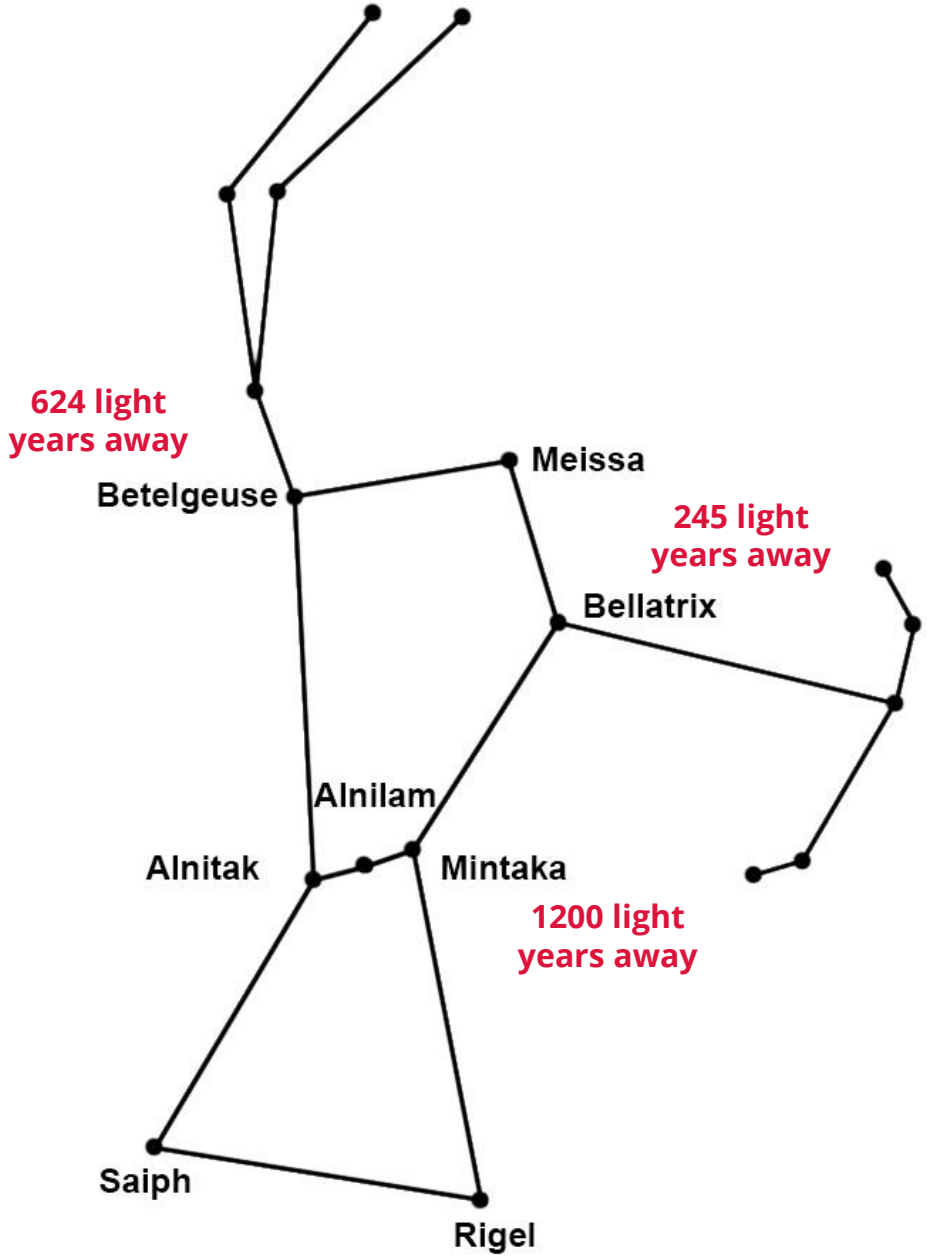
If you torture the data long enough, it will confess to anything.

From Darrell Huff's book *How to Lie With Statistics* (1954)

Truth is much too complicated to allow anything but approximations.

John von Neumann


Orion


624 light years away
Meissa
Betelgeuse
245 light years away
Bellatrix
Alnilam
Alnitak
Mintaka
1200 light years away
Saiph
Rigel

Mulla Nasrudin

Someone saw Nasrudin searching for something on the ground.

“What have you lost?, he asked.

“My key”, said the Mulla.

So they both went down on their knees and looked for it.

After some time the man asked: “Where exactly did you drop it?”

“In my own house”.

“Then why are you looking here?”

“There is more light here than inside my own house”.

– Sufi parable [Idris Shah, citing Mulla Nasrudin]

WORKING WITH AVAILABLE LIGHT

There is no substitute for getting to know your data.

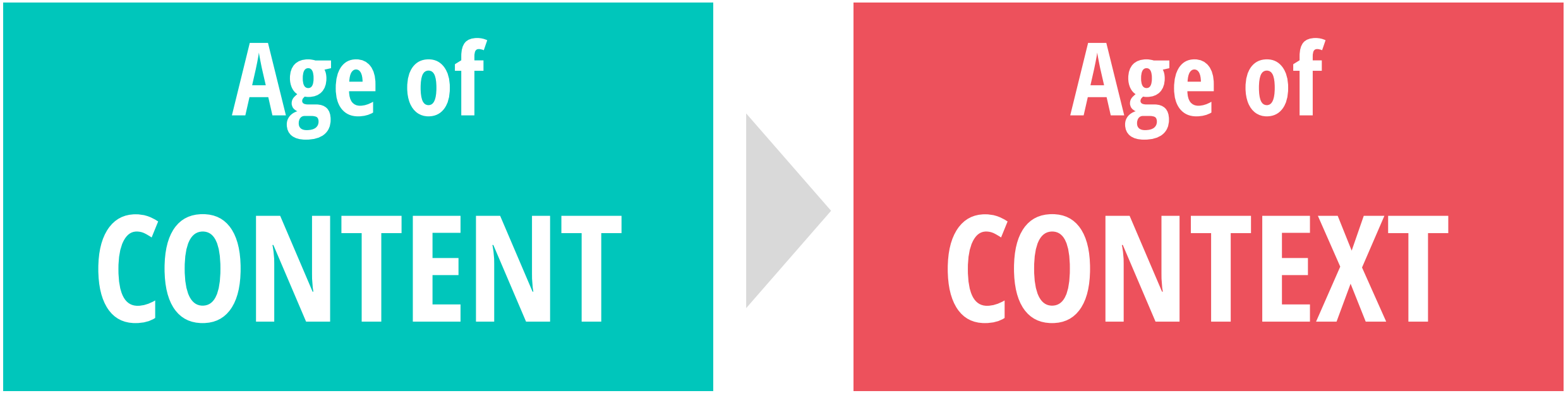
– Witten and Frank

Qualities of an Ideal [Data Scientist]

1. Curious, but skeptical
2. Critical thinking skills
3. Logical reasoning ability
4. Creativity
5. Strategic thinking
6. Ability to read the facts and understand assumptions
7. Understands necessary information and how to act on it
8. Engages with people to understand root of the problem
9. Ability to apply appropriate [data science] tools

“Before starting any project, I ask: What’s the geology, what’s the geomorphology, what’s the history, where does the wind come from, where does the sun come from, what are the shadow patterns, what’s the drainage system, what’s the flora?

…I try to be a contextual architect.” – **Glenn** Murcutt



Contextual Data Science

THANK YOU!!

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