DSPT
DATA SCIENCE PORTUGAL

The “D” in Data Science

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Objectives

My objective is to encourage you to:

> Understand the limits and consequences of your data

Motivation?

> To often I see data being used inappropriately
> To often I see inappropriate data being used

Outline

Google Flu Trends

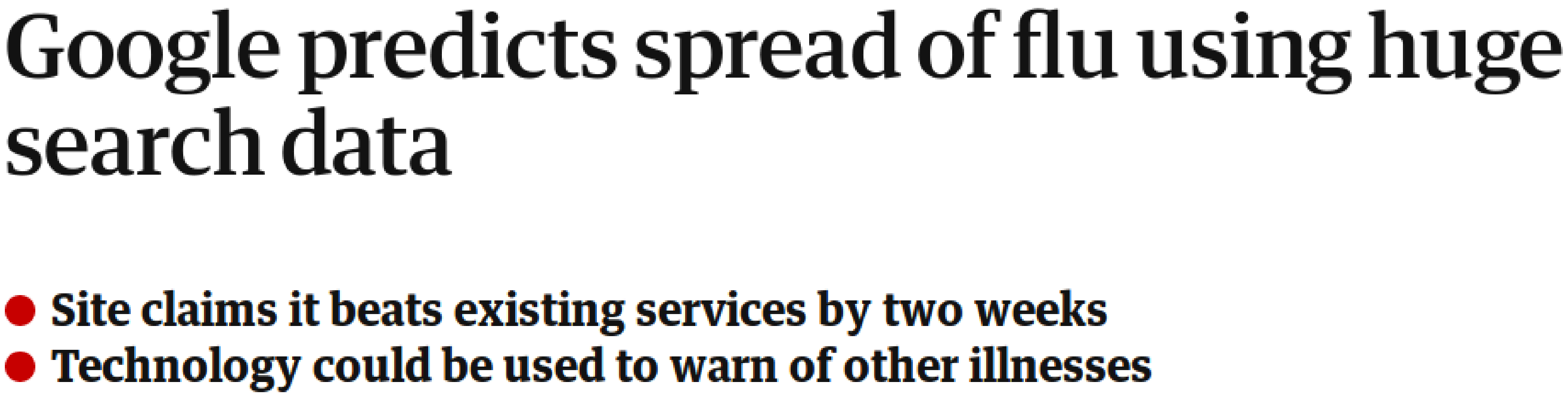
WHO Mortality Data

Translating Languages

Summary

The Guardian

13th November 2008



Google predicts spread of flu using huge search data

- Site claims it beats existing services by two weeks
- Technology could be used to warn of other illnesses

Source: https://www.theguardian.com/technology/2008/nov/13/google-internet

The Warning – Big News Headline

Big Data / Unicorn / Social Media / AI / …

saves humanity from

Disease / Dying / Fake News/ Bad stuff / …

The Warning – Big News Headline

Big Data / Unicorn / [illegible] a / AI / ...

saves [illegible] from

Disease / D [illegible] News/ Bad stuff / ...

RED ALERT

The Guardian

th November 2008

Google predicts uge search data

- Site claims i
- Technolo

DATA RED ALERT

Source: https://www.theg technology/2008/nov/13/google-internet

Google Flu Trends

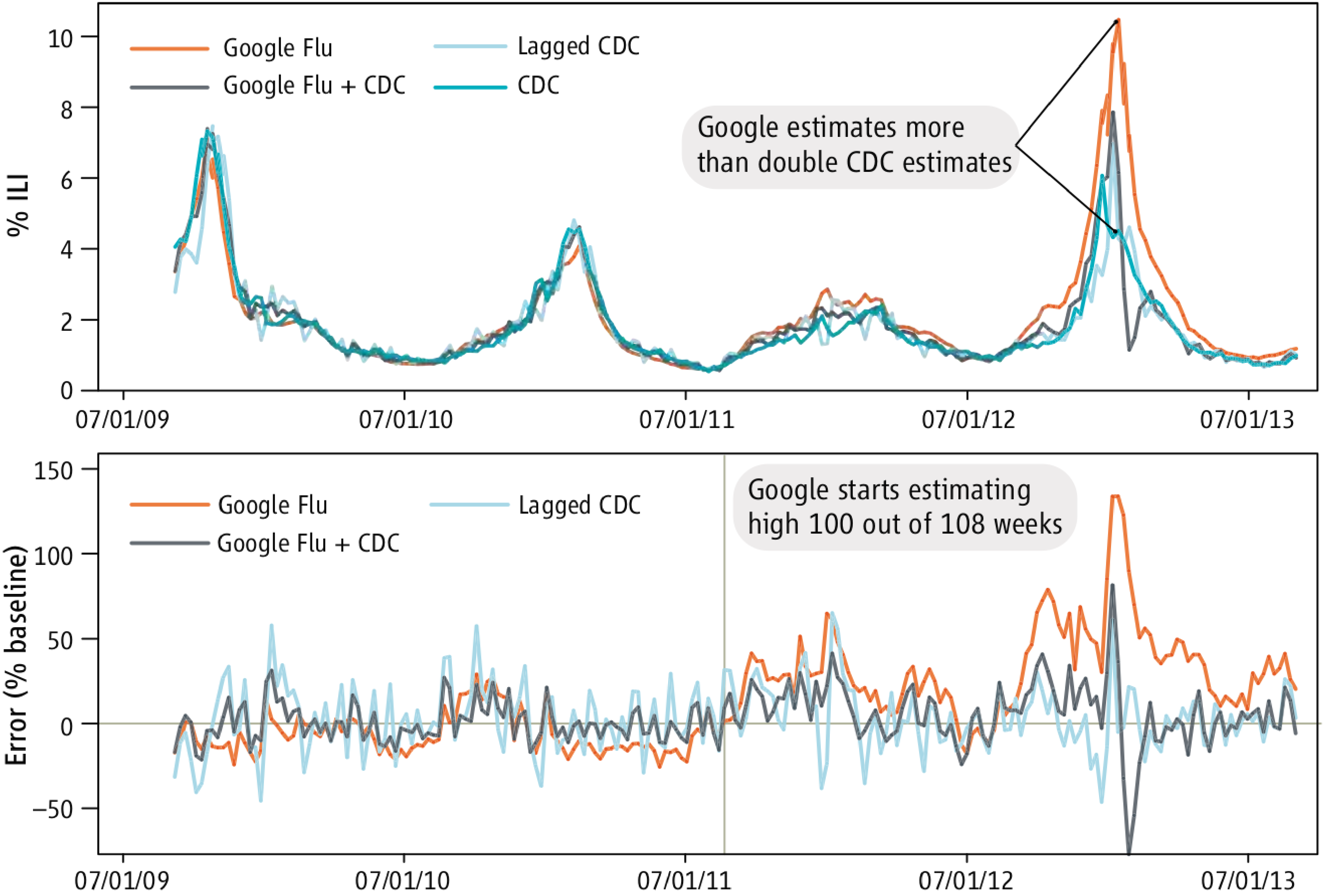
CDC
Centers for Disease Control and Prevention

> Best US predictions from Centre for Disease Control (CDC)

- Based on surveillance reports from labs across US
- By DESIGN - data and analyse give **reliable unbiased** predictions

> “Google searches” predict influenza like illness (ILI)

- Started with US and ended with 25 countries
- Found search terms **correlated with CDC data** (“training”)
- Then predicted using data from more recent searches
- Initially out performed CDC but then…



Source: http://science.sciencemag.org/content/343/6176/1203

My Main Issue…

- Essentially search terms were a “surrogate” for ILI
  - → Based on correlation with high CHANCE to find terms
- They are a bad surrogate
  - → Google tweaks algorithms (e.g. search box suggestions)
  - → People behaviour changes (e.g. news of bird flu epidemic)
  - → Correlation is not causation
- Surrogates have uses
  - → Blood pressure, cholesterol, … for cardiovascular events
  - → Well establish and widely recognised

We Could Use Official Health Data

CDC
Centers for Disease Control and Prevention

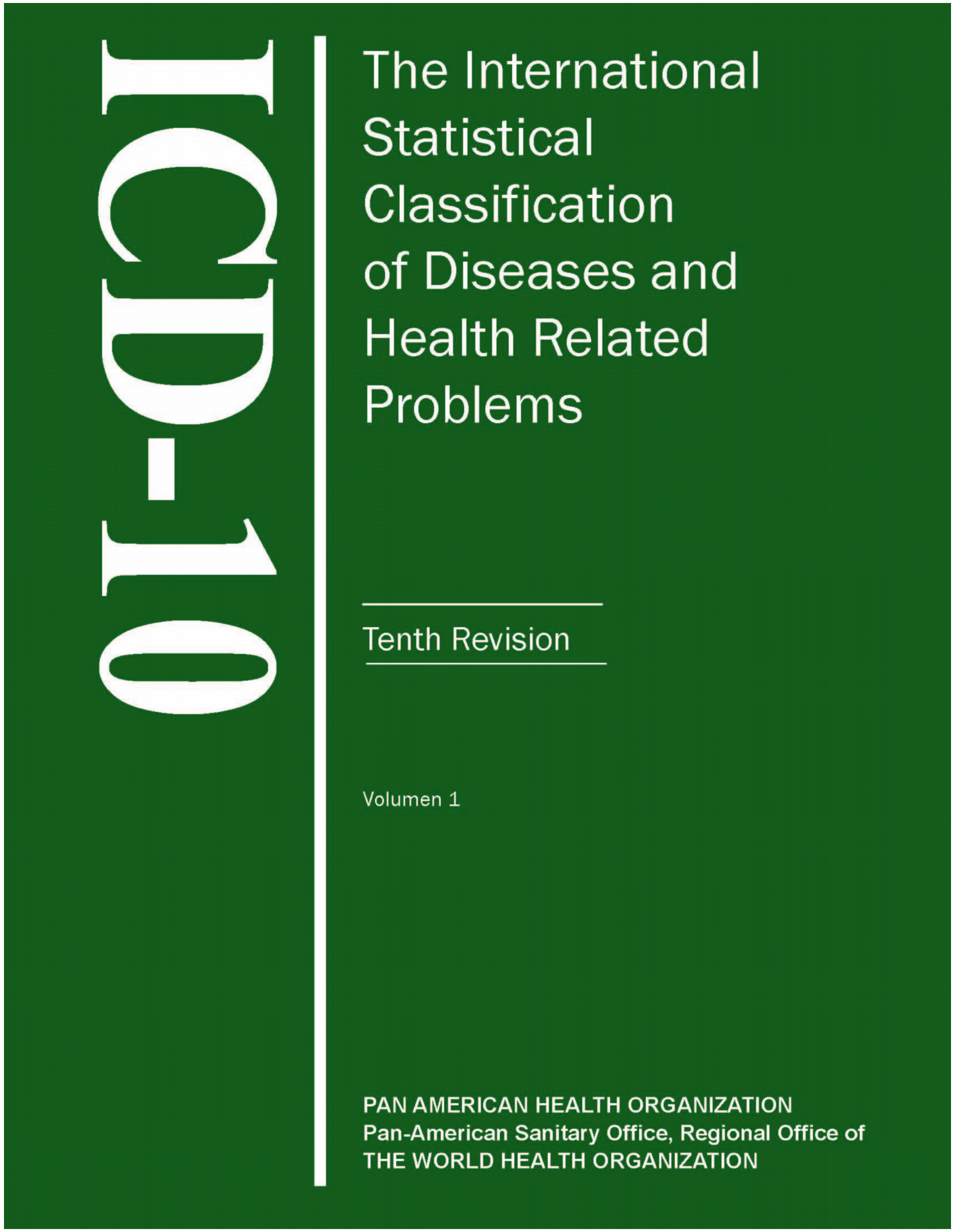
World Health Organization

Good Idea but...

There is always a story and data challenges...

- > **WHO Mortality Database**
- > **Data reported by country registration systems**
- > **Compilation of mortality data by:**
  - → **Age, sex, year and cause of death**
  - → **International Classification of Diseases (ICD)**

Source: http://www.who.int/healthinfo/mortality_data/en/



ICD-10

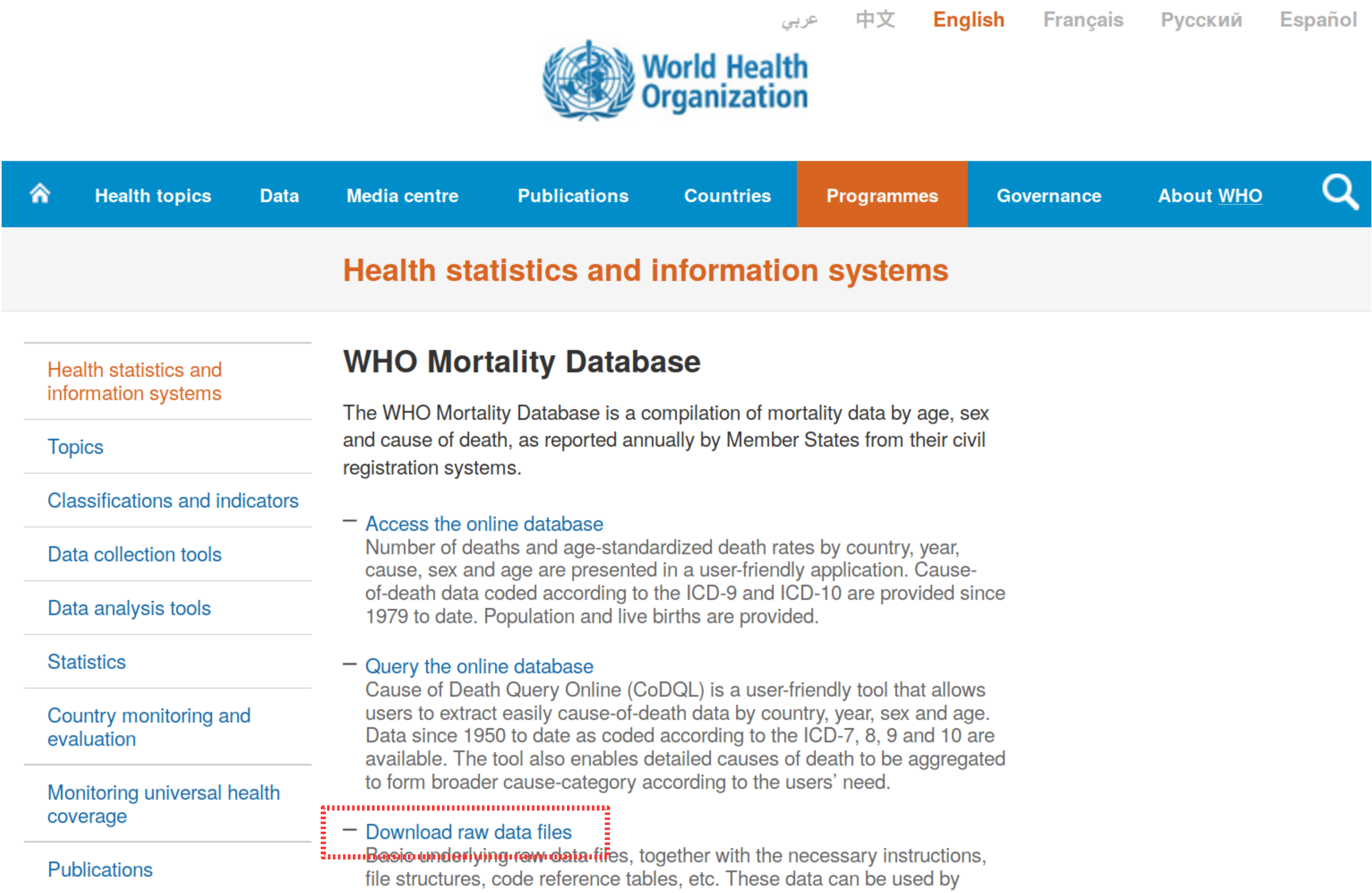
The International Statistical Classification of Diseases and Health Related Problems

Tenth Revision

Volumen 1

PAN AMERICAN HEALTH ORGANIZATION
Pan-American Sanitary Office, Regional Office of
THE WORLD HEALTH ORGANIZATION

ICD	Revised	Used
7	1955	1958 – 1967
8	1965	1968 – 1978
9	1975	1979 – 1994
10	1989	1995 –



Health statistics and information systems

- Health statistics and information systems
- Topics
- Classifications and indicators
- Data collection tools
- Data analysis tools
- Statistics
- Country monitoring and evaluation
- Monitoring universal health coverage
- Publications

WHO Mortality Database

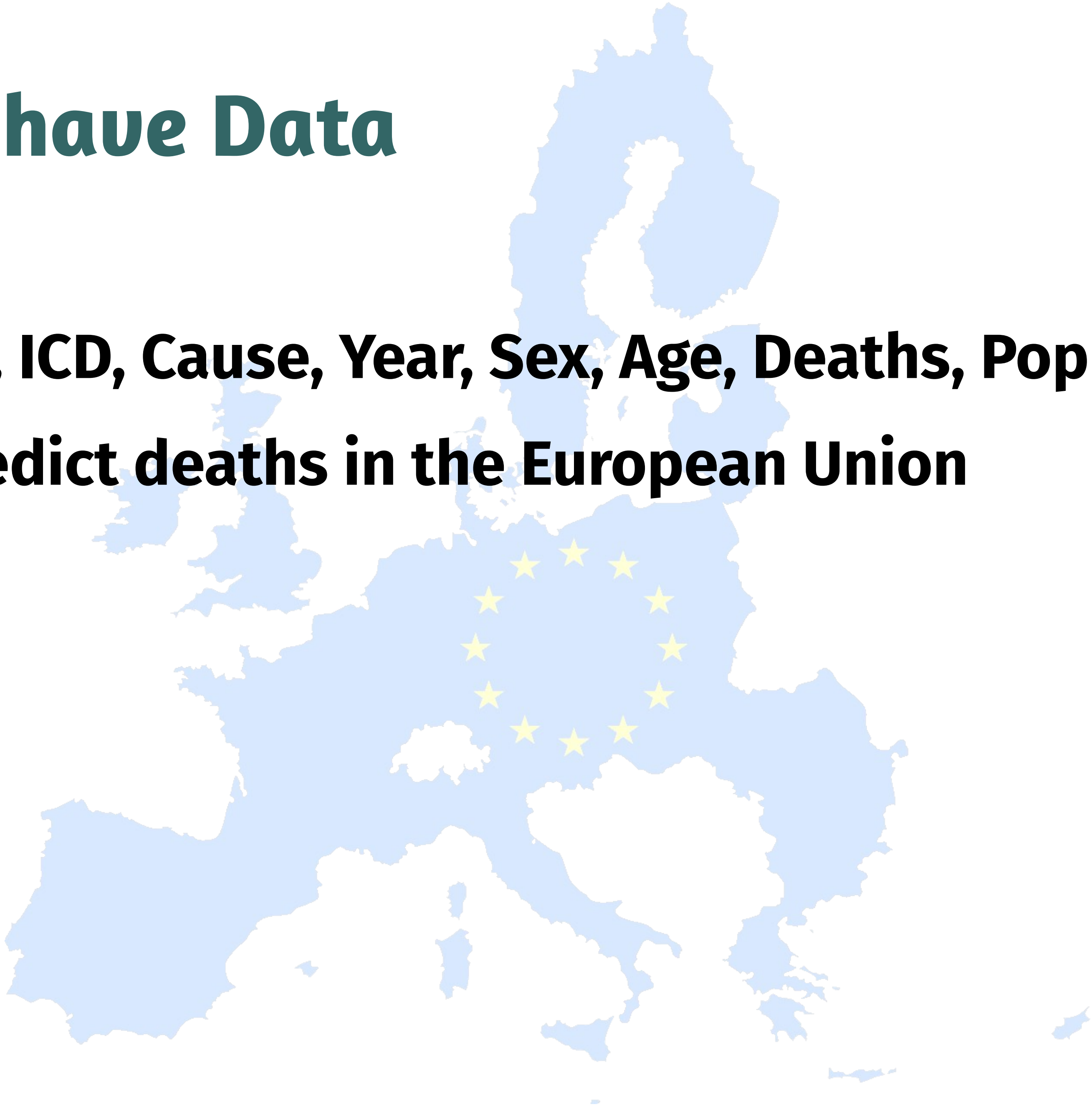
The WHO Mortality Database is a compilation of mortality data by age, sex and cause of death, as reported annually by Member States from their civil registration systems.

– Access the online database
Number of deaths and age-standardized death rates by country, year, cause, sex and age are presented in a user-friendly application. Cause-of-death data coded according to the ICD-9 and ICD-10 are provided since 1979 to date. Population and live births are provided.

– Query the online database
Cause of Death Query Online (CoDQL) is a user-friendly tool that allows users to extract easily cause-of-death data by country, year, sex and age. Data since 1950 to date as coded according to the ICD-7, 8, 9 and 10 are available. The tool also enables detailed causes of death to be aggregated to form broader cause-category according to the users' need.

– Download raw data files
Basic underlying raw data files, together with the necessary instructions, file structures, code reference tables, etc. These data can be used by

Yay we have Data



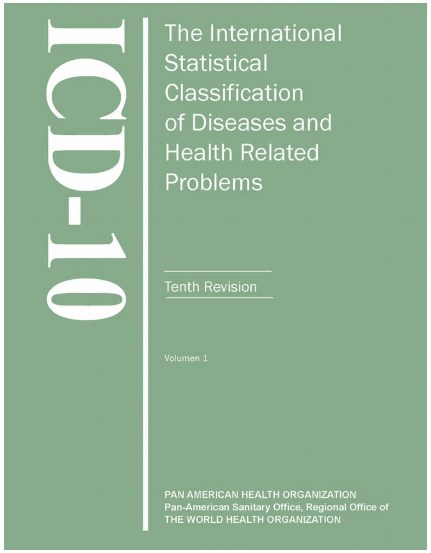
- Country, ICD, Cause, Year, Sex, Age, Deaths, Population
- Let’s predict deaths in the European Union
- But ...

Map source: https://commons.wikimedia.org/wiki/File:Flag_map_of_the_European_Union.png

Data Related Challenges (1)

- How do you define the European Union?
  - Start (1951) 6 countries – Now (2018) 28 countries
  - The UK has voted to leave (2019)
  - What is a fair comparison with the “EU average”?
- How do you define a country?
  - East and West Germany – Reunified in 1990
  - Czech Republic & Slovakia were formerly Czechoslovakia

Data Related Challenges (2)



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- How do you handle:
  - Partial coverage (e.g. cities only not rural)
  - ICD – Causes could be split or joined
  - Countries used ICD revisions at different times

- These issues have to be addressed by experts
  - Modelling (including ML & AI) **CANNOT** do this

“So what? I work with NLP!”

There is always a story and data challenges…

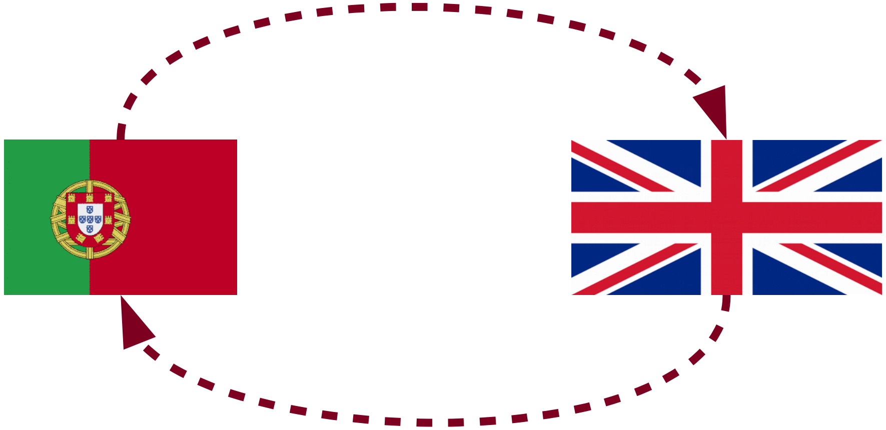
- **Natural Language Processing**
- **Sentiments Analysis**
- **Translation Engines**
- **…**

Languages & Translations

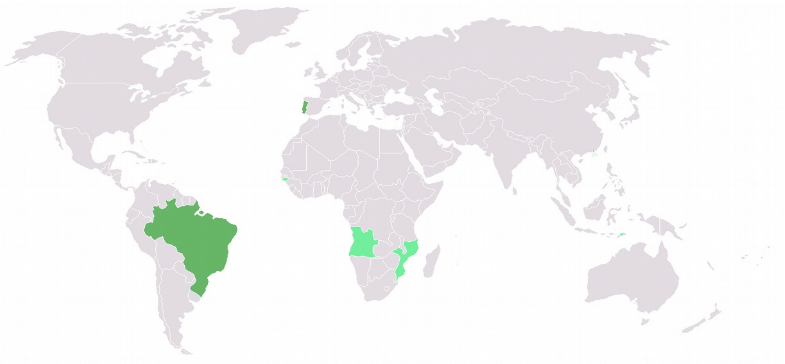
Imagine that we have **1 million** articles, books, regulations, *etc.* available in both Portuguese and English

> We plan to develop a translation system

> What potential data issues can you foresee?



Dialects & Styles



- > What is meant by "Portuguese" & "English"?
  - → Angolan, Brazilian, Mozambican, Portuguese...
  - → American, Australian, British, Caribbean, Indian, ...
  - → Even within each "language" there are differences
- > Does it make sense to mix articles, books, regulations, ...?
  - → Writing styles differ
  - → Legalese, technical, scientific, business, journalistic, ...

Map source: https://commons.wikimedia.org/wiki/File:Map-Lusophone_World.png

The Data?

> Where did the data come from and how?
  - → Randomly scraped from the web? Quality?

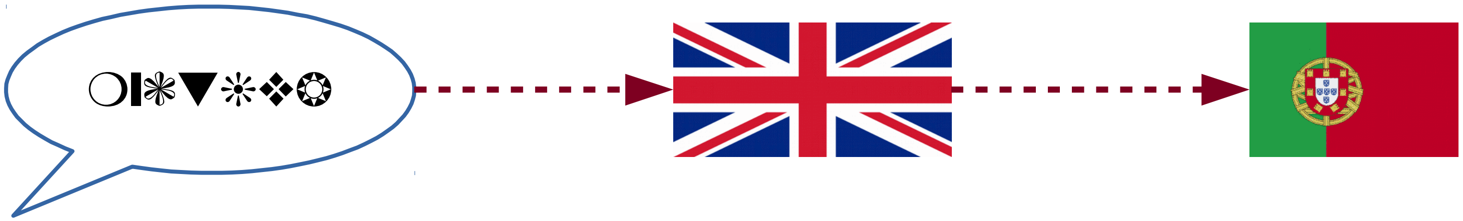
> Which periods are the translations from?
  - → Languages change over time
  - → How do you handle new words and phrases?

> How do you define “translation”?
  - → Word for word
  - → The author’s intention

Image source: https://commons.wikimedia.org/wiki/File:PessoaChapeu.jpg

Compromises can be made…

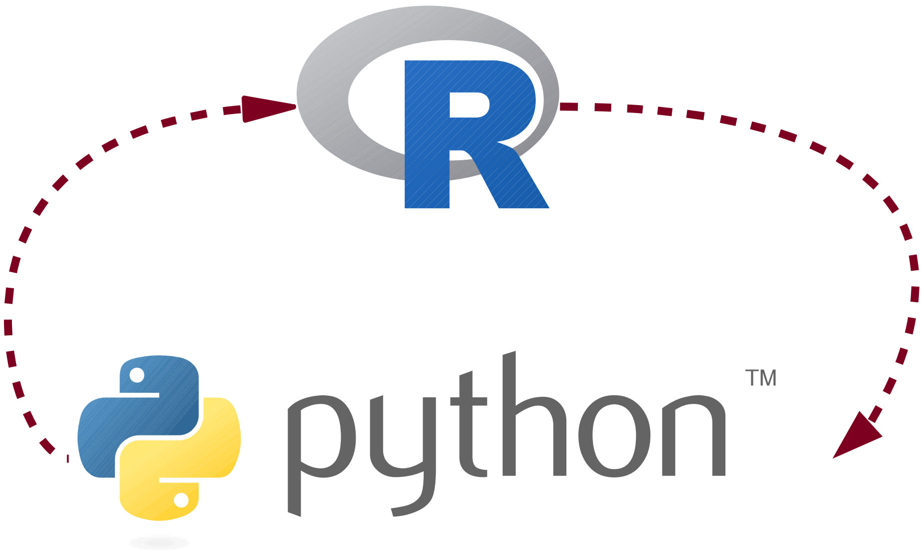
- Translating an “endangered” language
  - That is only translated into English but not Portuguese
- Translates “endangered” to Portuguese via English?
  - A rudimentary translation might be better than none
  - However users must be aware of the compromises



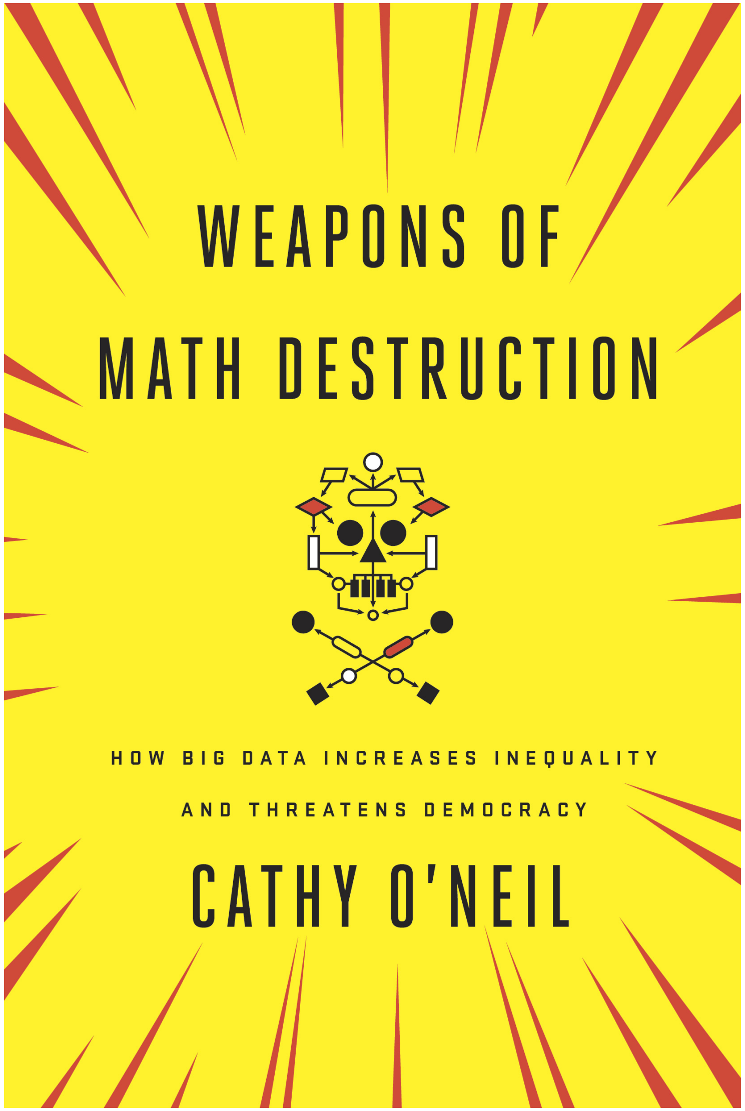
Vote

How confident would you be in an “A.I.” system that translates between R & Python?

- Very
- 50 – 50
- Erm sort of…
- Are you crazy?



Recommendation



Cathy O'Neil's website:

- https://mathbabe.org/

Ted talk:

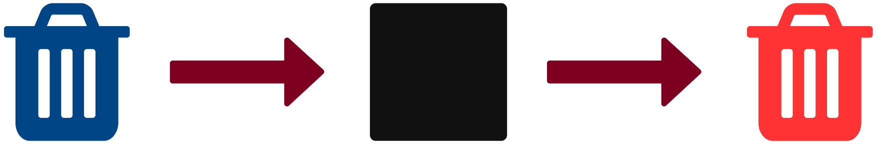
- https://youtu.be/_2u_eHHzRto

Google talk:

- https://youtu.be/TQHs8SA1qpk

Summary

- Data is often seen as a technical challenge
  - Cleaning & preparing it to summarise, visualise & analyse
- Do you really know and understand your data?
  - Are the data reliable and usable?
- Data have limits
  - Is your data appropriate? valid? biased?
- Analyses cannot save bad or inappropriate data
  - Garbage in, Garbage out



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Thank you

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