Colloquium du CERMICS

Responsible Data Management

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22 janvier 2020

Responsible Data Management

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DATA ANALYSIS MAY BE BIASED

Data out there

Data is exploding

Personal data

- Data and metadata we produce
- Data others (friends or not…) produce about us
- Data sensors produce about us
- Data programs produce about us

- 4V: Volume, veracity, velocity, variety

Individuals are losing control over all this data

Promises and risks of the digital world

- Improve people's lives, e.g., recommendation
- Accelerate scientific discovery, e.g., medicine
- Boost innovation, e.g., autonomous cars
- Transform society, e.g., open government
- Optimize business, e.g., advertisement targeting

Growing resentment

- Against bad behaviors: racism, terrorist sites, pedophilia, identity theft, cyberbullying, cybercrime
- Against companies: intrusive marketing, cryptic personalization and business decisions
- Against governments: NSA and its European counterparts

Increasing awareness of the dissymmetry between what these systems know about a person, and what the person actually knows

Online price discrimination

THE WALL STREET JOURNAL.

WHAT THEY KNOW

Websites Vary Prices, Deals Based on Users' Information

By JENNIFER VALENTINO-DEVRIES, JEREMY SINGER-VINE and ASHKAN SOLTANI
December 24, 2012

It was the same Swingline stapler, on the same Staples.com website. But for Kim Wamble, the price was $15.79, while the price on Trude Frizzell's screen, just a few miles away, was $14.29.

A key difference: where Staples seemed to think they were located.

WHAT PRICE WOULD YOU SEE?

lower prices offered to buyers who live in more affluent neighborhoods

https://www.wsj.com/articles/SB10001424127887323777204578189391813881534

Online job ads

theguardian

Samuel Gibbs

Wednesday 8 July 2015 11.29 BST

Women less likely to be shown ads for high-paid jobs on Google, study shows

Automated testing and analysis of company's advertising system reveals male job seekers are shown far more adverts for high-paying executive jobs

One experiment showed that Google displayed adverts for a career coaching service for executive jobs 1,852 times to the male group and only 318 times to the female group. Photograph: Alamy

The AdFisher tool simulated job seekers that did not differ in browsing behavior, preferences or demographic characteristics, except in gender.

One experiment showed that Google displayed ads for a career coaching service for "$200k+" executive jobs **1,852 times to the male group and only 318 times to the female group**. Another experiment, in July 2014, showed a similar trend but was not statistically significant.

https://www.theguardian.com/technology/2015/jul/08/women-less-likely-ads-high-paid-jobs-google-study

Racial bias in criminal sentencing

Machine Bias

There's software used across the country to predict future criminals. And it's biased against blacks.

by Julia Angwin, Jeff Larson, Surya Mattu and Lauren Kirchner, ProPublica
May 23, 2016

Bernard Parker, left, was rated high risk; Dylan Fugett was rated low risk. (Josh Ritchie for ProPublica)

A commercial tool COMPAS automatically predicts some categories of future crime to assist in bail and sentencing decisions. It is used in courts in the US.

The tool correctly predicts recidivism **61% of the time.**

Blacks are almost twice as likely as whites to be labeled a higher risk but not actually re-offend.

The tool makes **the opposite mistake among whites**: They are much more likely than blacks to be labeled lower risk but go on to commit other crimes.

https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing

Google antitrust case

theguardian

European commission announces antitrust charges against Google

Inquiry will focus on accusations that internet search and tech multinational has unfairly used its products to oust competitors

Sam Thielman in New York

@samthielman

Wednesday 15 April 2015 07.27 EDT

Ruth Porat replaces Patrick Pichette as Google's chief finance officer. Photograph: Georges Gobet/AFP/Getty Images

The European Union accused Google on Wednesday of cheating competitors by distorting Internet search results in favour of its Google Shopping service and also launched an antitrust probe into its Android mobile operating system.

Lack of diversity in social medias such as FB and Twitter

The 'Filter Bubble' Explains Why Trump Won and You Didn't See It Coming

By **Drake Baer**

Photo: Mark Wilson/Getty Images

Donald Trump's victory is blindsiding, like stepping into a crosswalk and getting slammed into by a delivery guy cycling the wrong way down a one-way street. This is because, as media scholars understand it, we increasingly live in a "filter bubble": The information we take in is so personalized that we're blind to other perspectives. It simultaneously explains why Trumpism has flourished and why so many of us are insulated from it.

Various ethical aspects

- Fairness: justice, staplers case
- Neutrality: Google search
- Transparency: Google add setting
- Diversity: filter bubble
- Privacy
- Explicability
- Accountability
- Loyalty
- Truth
- …

Challenges in data management

An opinion:

- In the past, the field was driven by
  - Company data
  - Data model & performance & reliability
- In the future
  - **Personal and social data**
  - **Ethical issues**

Ethics: concepts and principles that guide us in determining what behavior helps or harms us

We now have to learn to do things properly

We know how to do things: massive data management and analysis

- Good data models
- Query and transaction processing
- OLAP, data mining, statistical learning, machine learning
- Acceptable performance
- Acceptable reliability

Now is time to learn to do it properly

- Many societal issues today are related to data
- Just look at the news: fake news, privacy leaks, hate messages, information bubble…

Organization

- ✓ Motivation
- Privacy
- Data analysis
- Data quality evaluation
- Conclusion

"I think you'll find that mine is bigger..."

1. Data privacy
2. The PIMS

PRIVACY

Data privacy

- More and more concerns about privacy
- Limitations on what data companies can do
  - Laws to force companies to request authorization to build a DB with of personal information (France)
- Rules about what users should be able to do
  - Laws that compel companies (e.g., credit reporting agencies) to let users see and correct information about them (US)
- Laws in Europe, US…
  - The laws depend on the country (the ethics also of course)
  - Their enforcement is difficult
- This is progressing: in particular, GDPR

Data privacy: usability

- There are means to protect data but people often don’t use them because too complicated and/or not understandable
  - Tools for cryptography
  - Access rights
  - Unreadable EULA
    - End-User license agreement
  - Difficulty to change service
    - Vendor lock in

Research issues

- Easier to use tools
- Automatic specification
- Interoperability
- Portability…

An alternative business model for data protection: The PIMS

*A **Personal Information Management System** is a cloud system that manages all the information of a person*

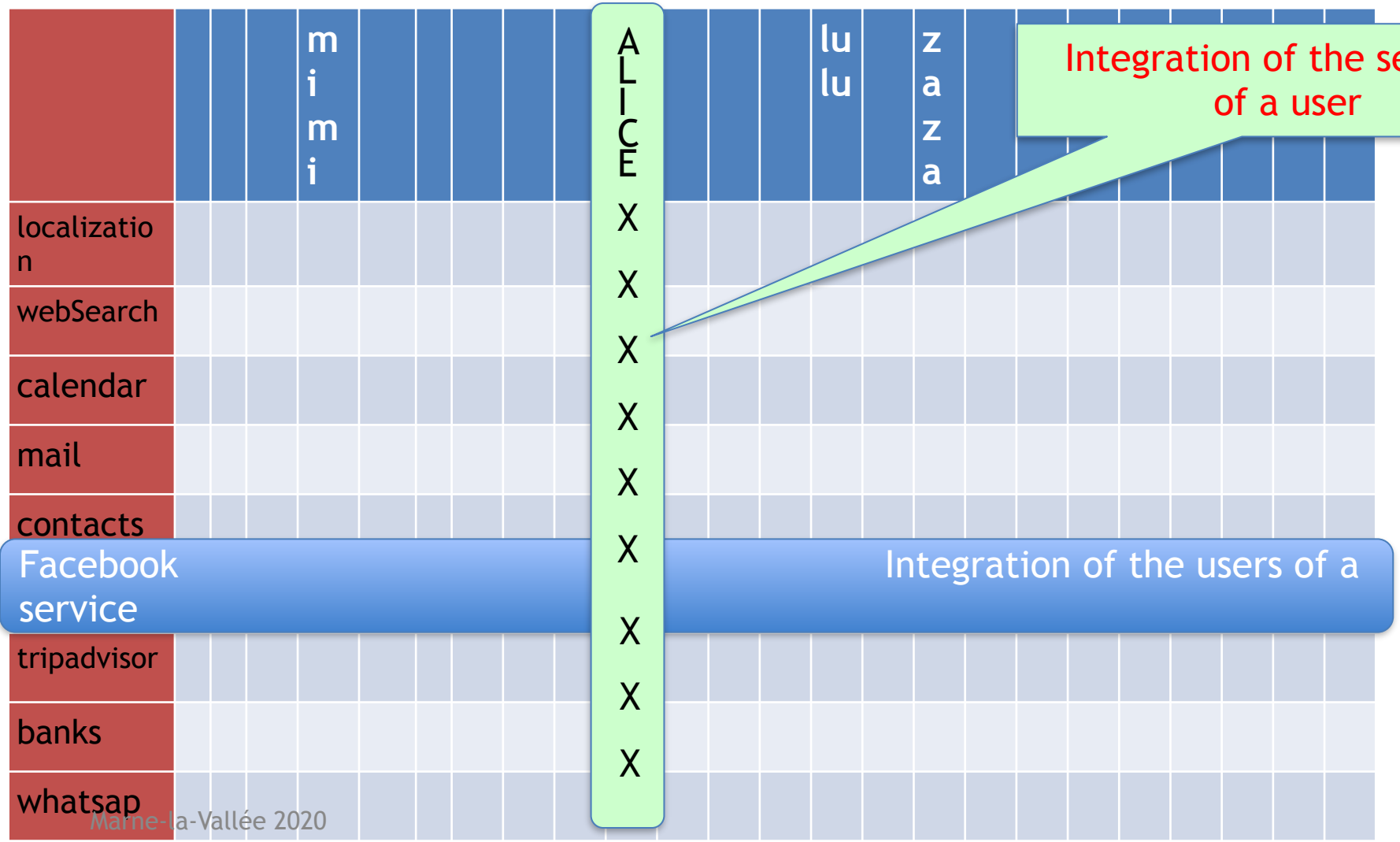
Many Web services
Each one running

- On some unknown machines
- With your data
- Some software

Your PIMS

- **Your machine**
- **With your data**
  - possibly replica of data from systems you like
- On your software or
- Wrappers to external services

It’s first about data integration



Many R&D issues

Old problems revisited

- Personal information integration
- Personalization and context awareness
- Personal data analysis
- Epsilon-principle (epsilon-user-administration)
- Synchronization/backups & Task sequencing
- Access control & Exchange of information
- Security (e.g. works @ INRIA Saclay)
- Connected objects control

1. Fairness
2. Transparency
3. Diversity
4. Privacy

DATA ANALYSIS

Getting knowledge out of data

- Finding statistical correlations
- Publishing aggregate statistics
- Detecting outliers
- Detecting trends
- Popular technology
  - statistics, data mining, big data, machine learning

Data analysis: Fairness

- Origins of bias
  - data collection
    - E.g., a crime dataset in which some cities are under-represented
  - data analysis

    E.g., search engine skewing recommendations in favor of advertising customers
- The bias may be unexpected
  - Staplers more expensive for low income families
- The bias may even be illegal
  - Less advantageous financial products to members of minority groups

The issue is well-known in science

  - Scientists are expected to explain how data was obtained, which analysis was carried on it

Effect on sub-populations

Simpson's paradox
disparate impact at the full population level disappears or reverses when looking at sub-populations!

		grad school admissions	
		admitted	denied
gender	F	1512	2809
	M	3715	4727

positive outcomes

35% of women

44% of men

UC Berkeley 1973: women applied to more competitive departments, with low rates of admission among qualified applicants.

Data analysis: Diversity

- Relevance ranking (for recommendation)

  is typically based on popularity
  - Ignores less common information (in the tail) that constitutes in fact the overwhelming majority
  - Lack of diversity can lead to discrimination, exclusion.
- Examples
  - on-line dating platform like Match.com
  - a crowdsourcing marketplace like Amazon Mechanical Turk
  - or a funding platform like Kickstarter

The rich get richer, the poor get poorer

Data analysis: Transparency

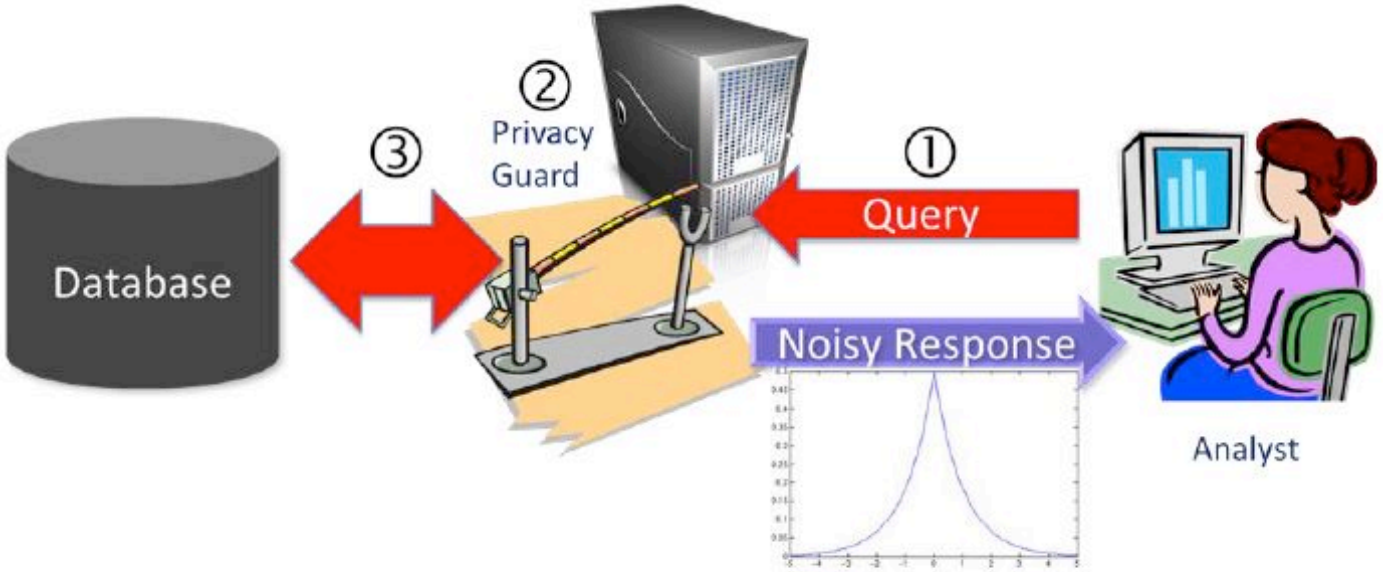
- Example: lack of transparency in Facebook data processing
  - In general, unreadable End-user license agreement
- Users want to control what is recorded about them, and how that information is used
- Transparency facilitates verification that a service performs as it should, as is promised
- Also allows a data provider to verify that data are well used as it has specified.

Privacy in data analysis

- When publishing statistics,

  protect individuals
- Anonymization
- Differential privacy

Many open issues



Issues: Verifying these properties

- Tools to collect data and analyze it responsibly
- Tools to verify that some analysis was performed responsibly
- Easier if responsibility is taken into account as early as possible, *responsibility by design*
- To check the behavior of a program, one can
  - Analyze its code ≈ proof of mathematical theorems
  - Analyze its effect ≈ study of phenomena (such as climate or the human heart)

Verification: code analysis

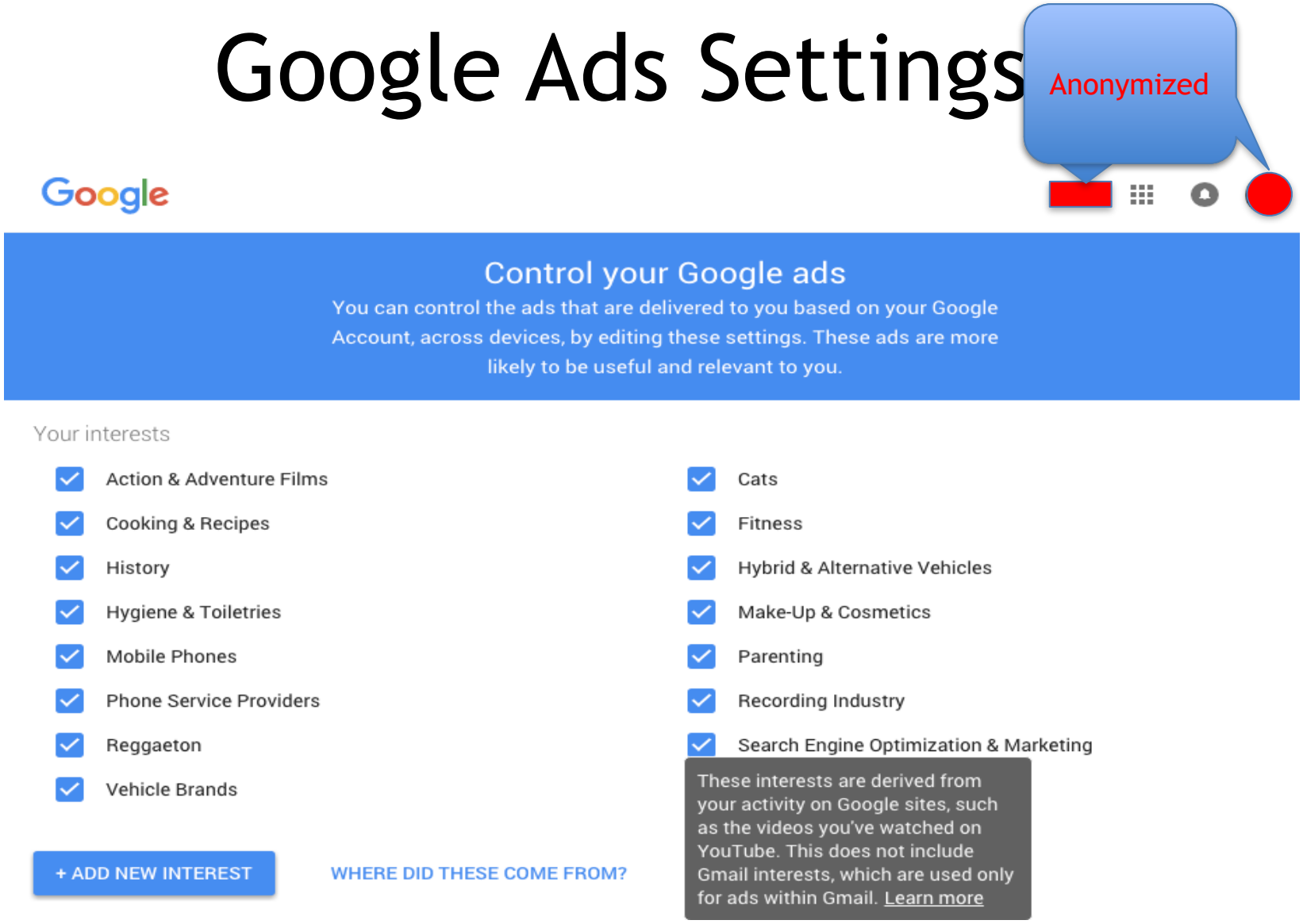
- Possible if open-source - otherwise auditing
- Easier with open-source
  - not sufficient: bug in the SSL library of Debian
  - Weak secrecy of keys for 2 years
- Specify properties that should be verified
- Verification based on static analysis, in the spirit of theorem proving
- Lots of work in different areas
  - security, safety, optimization, privacy
- Little on responsibility

Verification: analysis of effects

- Statistical analysis
  - Detect biases
  - Detect illegal use of protected attributes
- Verify transparency
- Verify “loyalty”
  - The system behaves like it says it does

- Example: Google Ads Settings & AdFisher

Google Ads Settings



Transparency and accountability

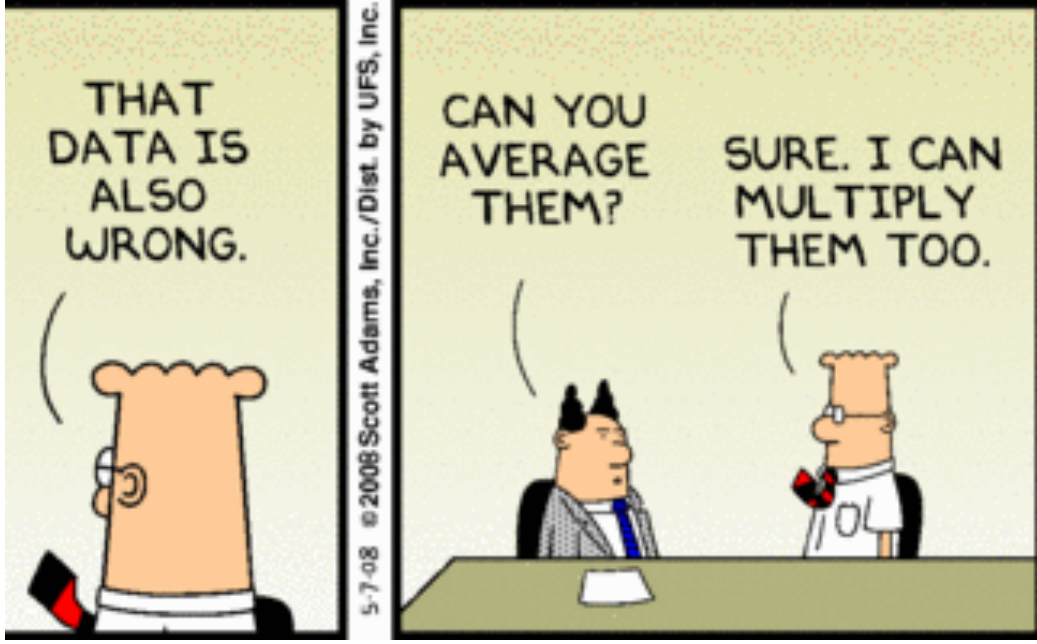
- Analysis by AdFisher
- Doesn’t behave how it says
  - Choice of ads is based on more data that it says
    - E.g., protected attributes
    - Eg: males were shown ads for higher-paying jobs significantly more often than females
- Some control on the ads
  - Removing an interest decreases the number of ads related to that interest
  - Eg: cats

Verification: provenance

- Provenance helps verifying the analysis
- Common for scientific data, essential for verifying that data collection and analysis were performed responsibly

Issue: provenance and verification

Issue: reproducibility



DATA QUALITY EVALUATION

Stuff we don’t want to see on the web

- Fake news, alternative facts
- Nazi sites
- Terrorist sites
- Pedophiliac content
- Bogus health content
- Conspiracy theory content
- Cybercrime
- Cyberbullying …

Web-scale data analysis

About human data
- Errors, omissions, inconsistences, biases, incompleteness
- Typically subjective (taste, opinions…)

- Quality assessment
  - Of facts
  - Of data sources
  - Assess correctness/legality/…
- Truth finding
  - Fake news detection

On line data analysis

- 2013: A tweet from The Associated Press Twitter account claiming the White House had been bombed
- the Dow dropped more than 100 points in two minutes

- Automatic Web scale content monitoring

Moderation in social medias

- Report on hatespeech in Facebook in 2019 for the French Government
- More than 15 000 moderators for FB
- Block contents contradicting FB Community rules
- Algorithmic detection
  - Comparison with human moderation
- ML detection in text, images, videos
- Depends on the topic : terrorism, pedopornography, hatespeech, fakenews, cyberbullying, copyright violation
- Context and general knowledge

Neutrality

Net and platform neutrality (CNNum report)

- net neutrality - the network is transporting data with no bias based on source, destination, content …
- platform neutrality - big internet platforms should not discriminate in favor of their own services
- Related to fairness and diversity, verified with transparency tools

Conclusion

With great power comes great responsibility, Uncle Ben, Spiderman

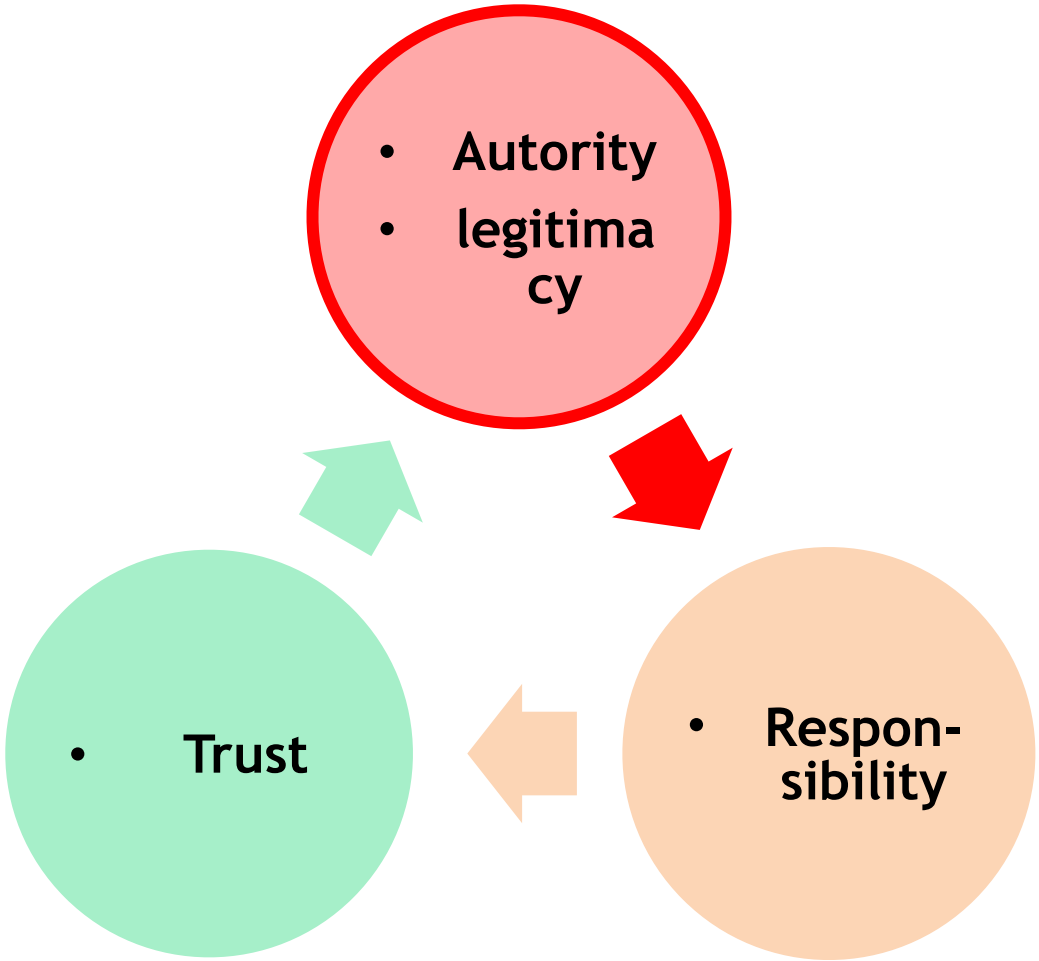
Context

Power

- A handful of big players command most of the world's computational resources and most of the data, including all of your personal data - an oligopoly

Danger

- Threatens fair business competition
- Controls what information you receive
- Can guide your decisions
- Can infringe on your privacy and freedom
- Limits your freedom


• Autority
• legitima cy
• Respon- sibility
• Trust

The authority of a government is founded on its legitimacy

l'Assemblée nationale reconnaît et déclare,
en présence et sous les auspices de l'Être Suprême,
les droits suivants de l'homme et du citoyen.

Préambule de la Déclaration de 1789

Le peuple français *proclame solennellement son attachement aux* ***Droits de l'homme*** *et aux principes de la souveraineté nationale tels qu'ils ont été définis par la* ***Déclaration de 1789***

Préambule de la Constitution de 1958

The big digital platforms

- A triptych: a territory, a population, an authority
- Territory: A portion of cyberspace
  - Population: Social media users
  - 6 over 1 billion active users - only 2 states
  - Facebook - 2.234 billion active users per month
  - YouTube, WhatsApp, Messenger, WeChat, Instagram
- Authority: The ability to develop rules and enforce them by using only legitimate constraint (closing accounts and deleting content)

Where is their legitimacy?

- They are just companies
- We choose them by subscribing, contributing, by our attention
  - Limit of our choice: monopoly, opacity
- They have not been elected
- Where do they get their authority from?
- What is the place of citizens in this system?
  - Do they participate in decisions? Are they well informed?
- How does their authority relate to that of our democracies?

How can scientists contribute?

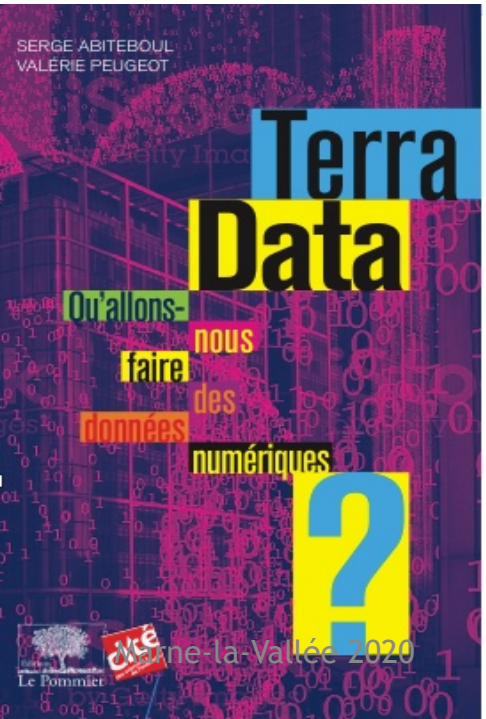
Many societal and political fights today are related to computer science and digital data

Work on ethical solutions

Explain technology to the general public

Participate as citizens to the important choices coming


le temps des
algorithmes
serge abiteboul
et gilles dowek
[ESSAI LE POMMIER !]


SERGE ABITEBOUL
VALÉRIE PEUGEOT
Terra Data
Qu'allons-nous faire des données numériques ?
Le Pommier


Le bot qui murmurait à l'oreille de la vieille dame
et autres nouvelles numériques
Serge Abiteboul
Le Pommier
Échappées


MERCI ! THANK YOU !
FRAPAR.