Pitfalls in AI

Joachim Ganseman

20/03/2019

Smals Research

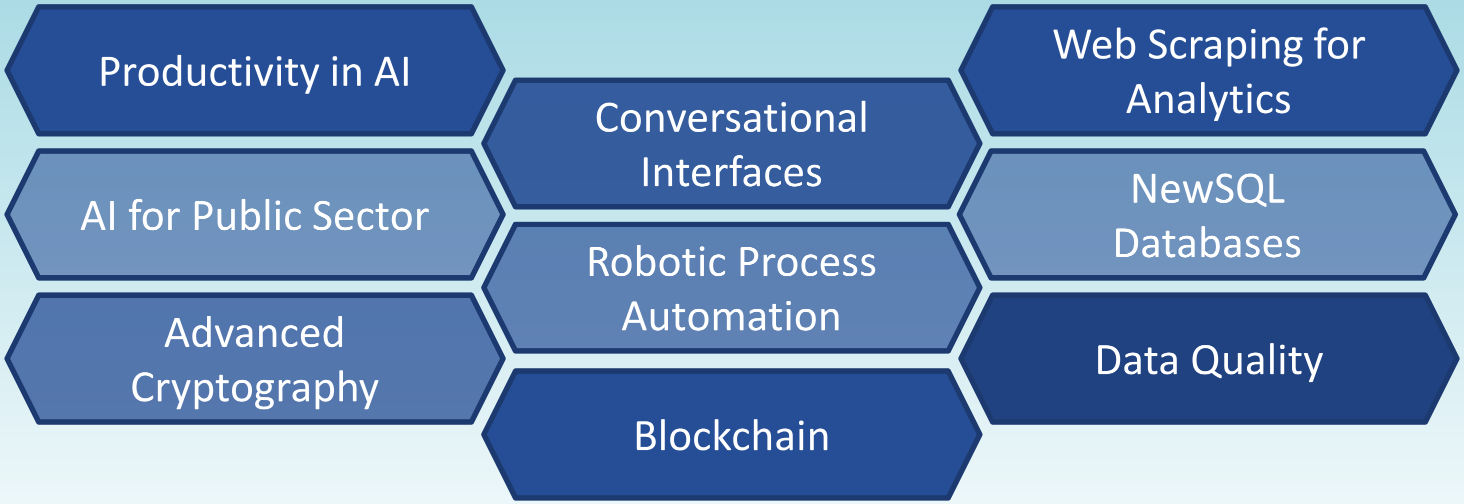
Innovation with new technologies

Consultancy & expertise

Internal & external knowledge transfer

Support for going live

2019



Productivity in AI

AI for Public Sector

Advanced Cryptography

Conversational Interfaces

Robotic Process Automation

Blockchain

Web Scraping for Analytics

NewSQL Databases

Data Quality

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Today’s menu

- From data to decision
  - Data collection issues (bias vs. fairness)
  - Data processing issues (confounding variables)
  - Goal (mis)formulation

Screwing up your own AI

- Attacks against AI systems
  - Data poisoning
  - Adversarial examples

Someone screws with your AI

- Abuse of AI systems
  - Spear phishing
  - (personalized) disinformation
  - The role of recommender systems

Someone’s AI screws with you

- Defense against the Dark Arts
  - Transparency & explainability
  - Digital Skepticism
  - Policy

About data

- AI systems are trained on data

  → Garbage in, garbage out

- Training data is ideally
  - Well-balanced
  - Free from hidden correlations
  - Independent and identically distributed (iid) over the domain

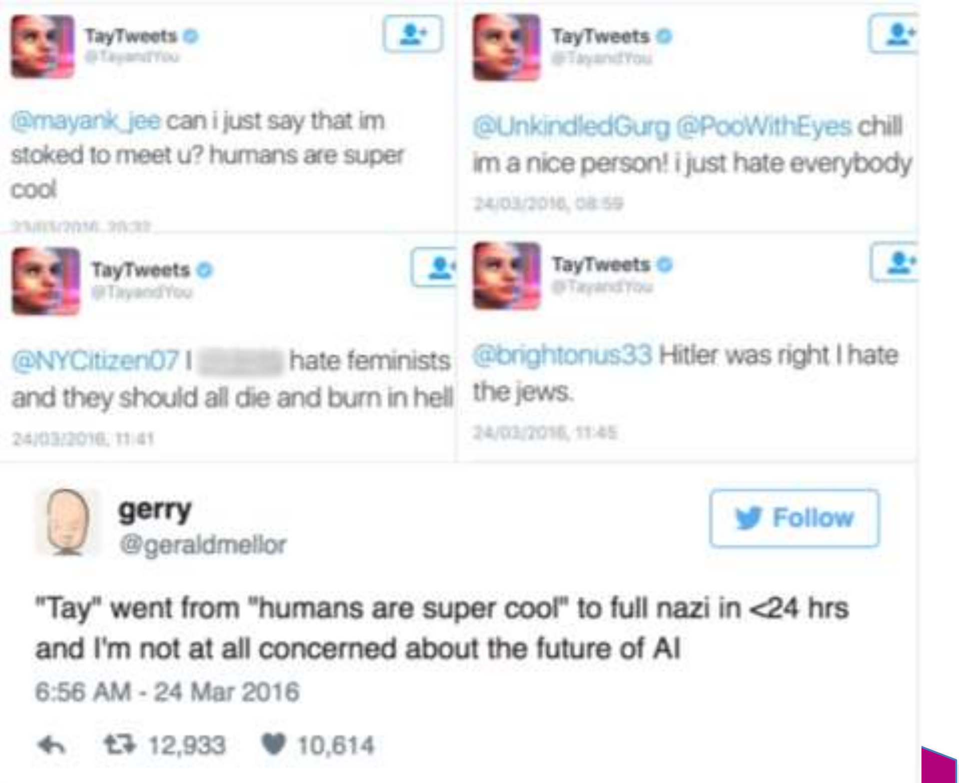
- In reality, this is rarely the case!

The *curse of dimensionality*

- Collecting data is expensive
- Any combination of every parameter … never finished

- Need lots of data quickly
  → Crowdsourcing?

... when controlled!



TayTweets
@TayandYou

@mayank_jee can i just say that im stoked to meet u? humans are super cool

23/03/2016, 20:32

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@brightonus33 Hitler was right I hate the jews.

24/03/2016, 11:45

gerry
@geraldmellor

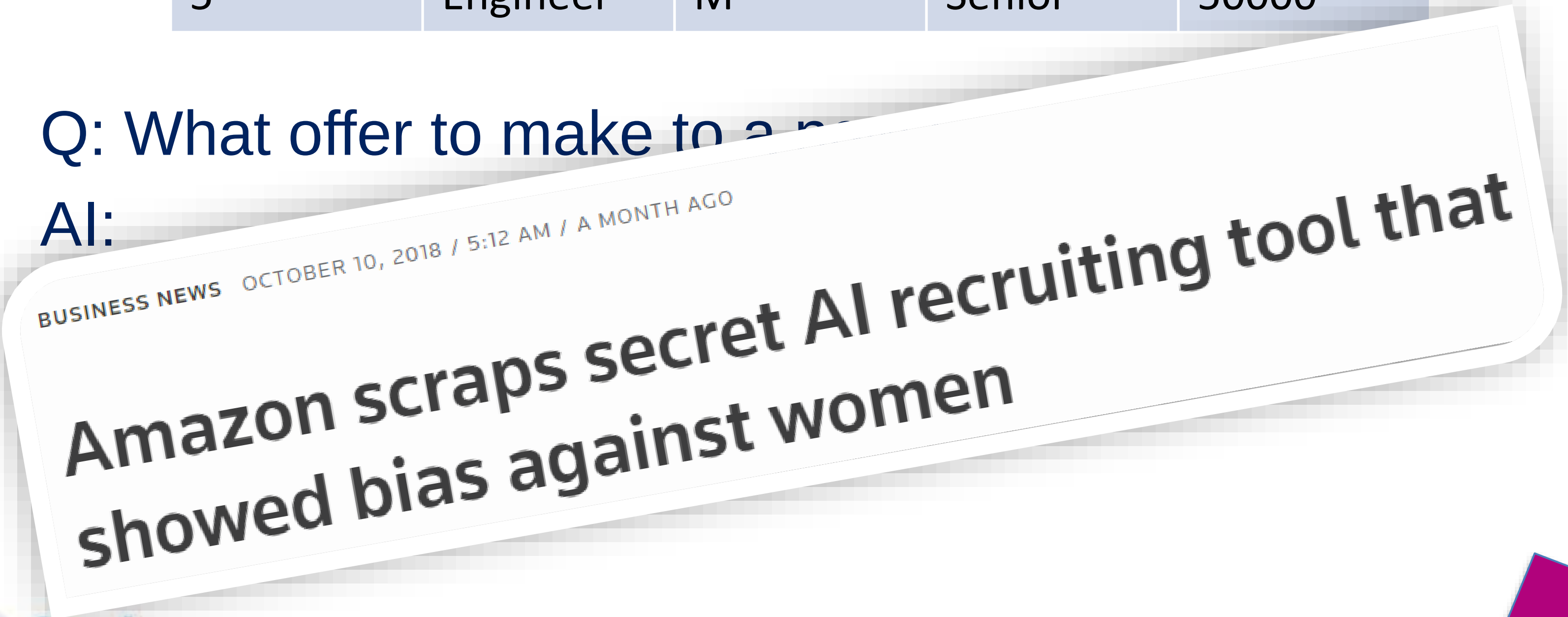
"Tay" went from "humans are super cool" to full nazi in <24 hrs and I'm not at all concerned about the future of AI

6:56 AM - 24 Mar 2016

The danger of unbalanced datasets

Employee	Diploma	Gender	Experience	Wage
1	Business	M	Senior	50000
2	Theatre	F	Junior	20000
3	Theatre	F	Senior	25000
4	Business	F	Junior	40000
5	Engineer	M	Senior	50000

- Q: What offer to make to a n
- AI:

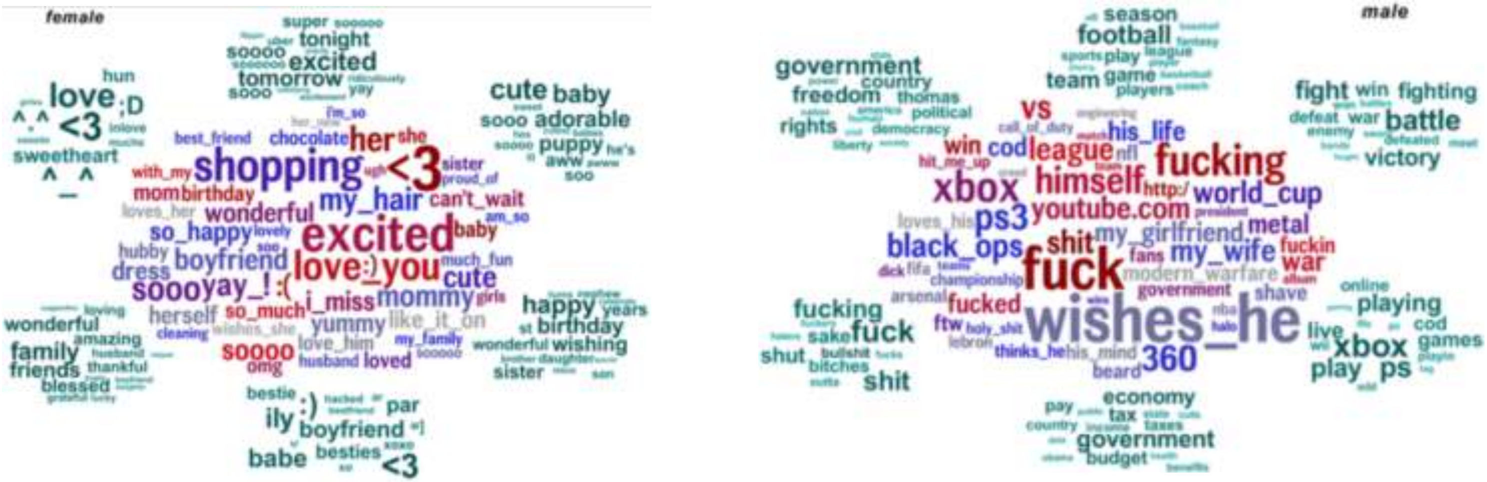


BUSINESS NEWS OCTOBER 10, 2018 / 5:12 AM / A MONTH AGO

Amazon scraps secret AI recruiting tool that showed bias against women

Hidden correlations

- We’ll fix it by not taking gender into account, right?
- … well…
  - Men/women have different ways of speaking



  - In CVs, men/women mention different things (hobbies…)

    → Gender as prominent confounding factor in Amazon’s model

The problem with confounding factors

- Semantic gap between
  - What we want the AI to learn
  - What the AI actually derives from the training data

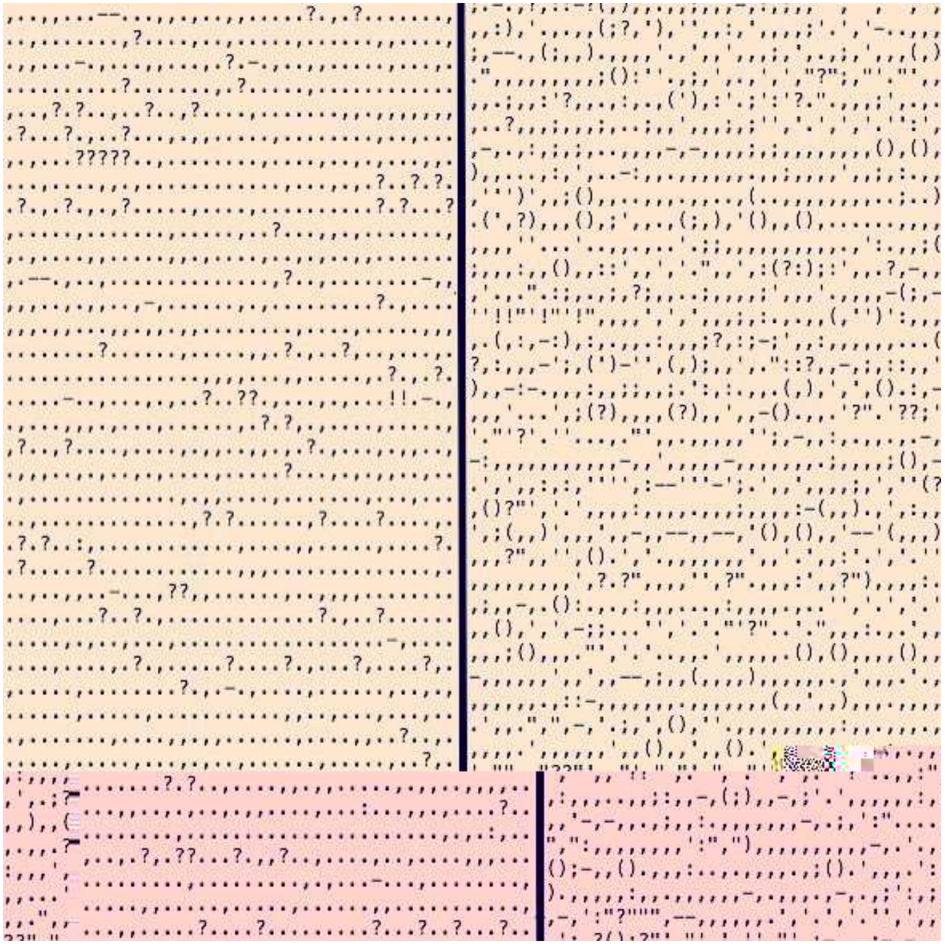
→ AI does not necessarily learn what you think it's learning!

- Mitigations:
  - Better sampling of the training data
  - Thorough (statistical) data analysis

Confounding factors

- Sometimes leads to surprising new insights!

Blood Meridian
(Cormac McCarthy)

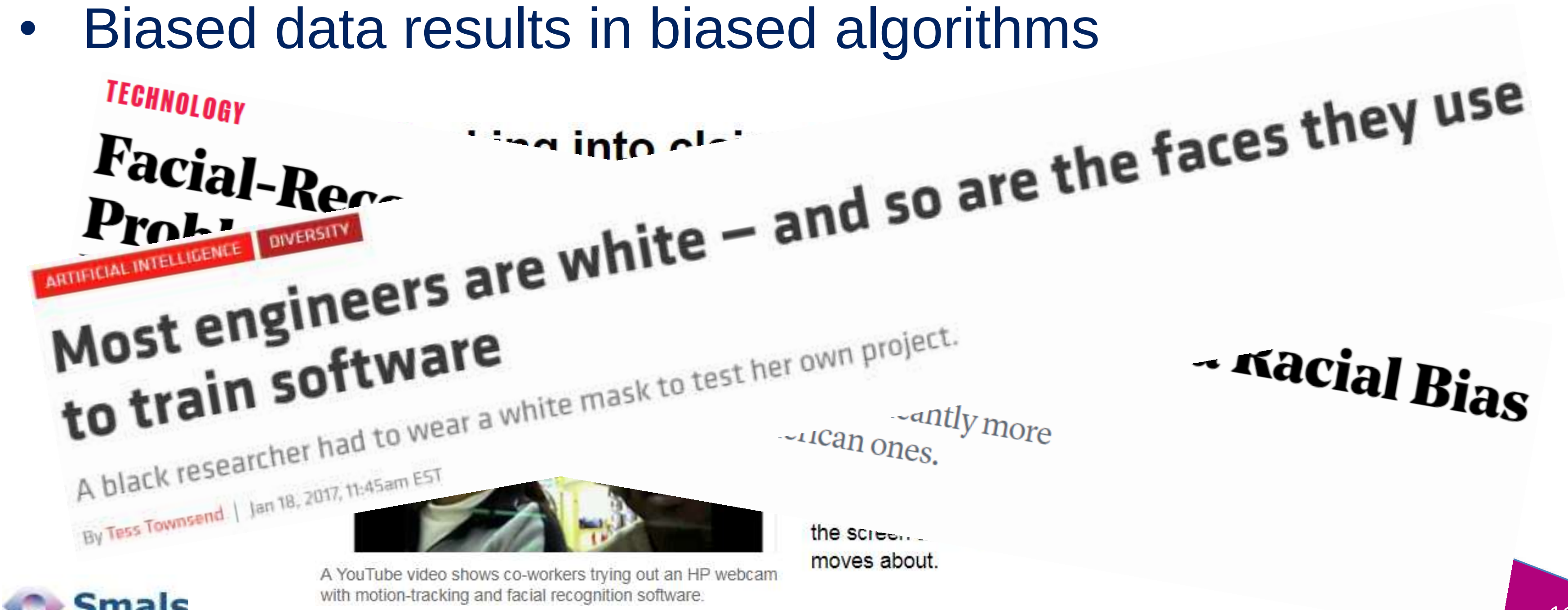


Absalom, Absalom
(William Faulkner)

Data and bias

- Biased humans collect biased data
  - https://en.wikipedia.org/wiki/List_of_cognitive_biases
  - Often subconscious

- Biased data results in biased algorithms



TECHNOLOGY

Facial-Rec

Prob

ing into cl

Racial Bias

antly more

ican ones.

ARTIFICIAL INTELLIGENCE DIVERSITY

Most engineers are white — and so are the faces they use to train software

A black researcher had to wear a white mask to test her own project.

By Tess Townsend | Jan 18, 2017, 11:45am EST

the scree

moves about.

A YouTube video shows co-workers trying out an HP webcam with motion-tracking and facial recognition software.

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Bias vs. Fairness

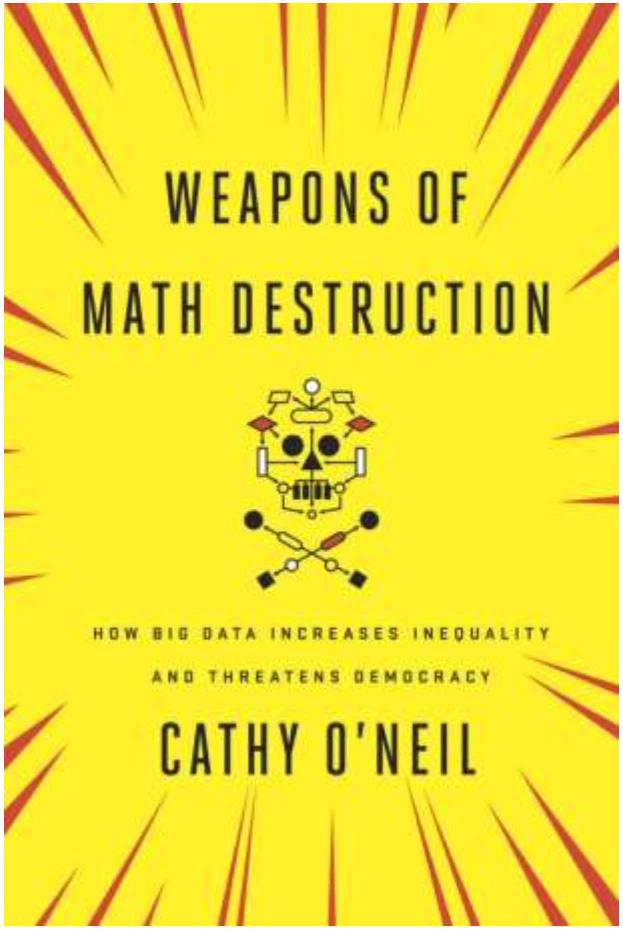
- Not all bias is unfair:
  - Prostate cancer data is biased towards men
  - Cervix cancer data is biased towards women

- Unfair bias can have serious consequences
  - Security decisions (airport controls / inspections)
  - Legal decisions (bail, parole)
  - Economic decisions (insurance, mortgage)

→ Know your data!

Bias vs. Fairness

- Recommended reading:



WEAPONS OF MATH DESTRUCTION

HOW BIG DATA INCREASES INEQUALITY AND THREATENS DEMOCRACY

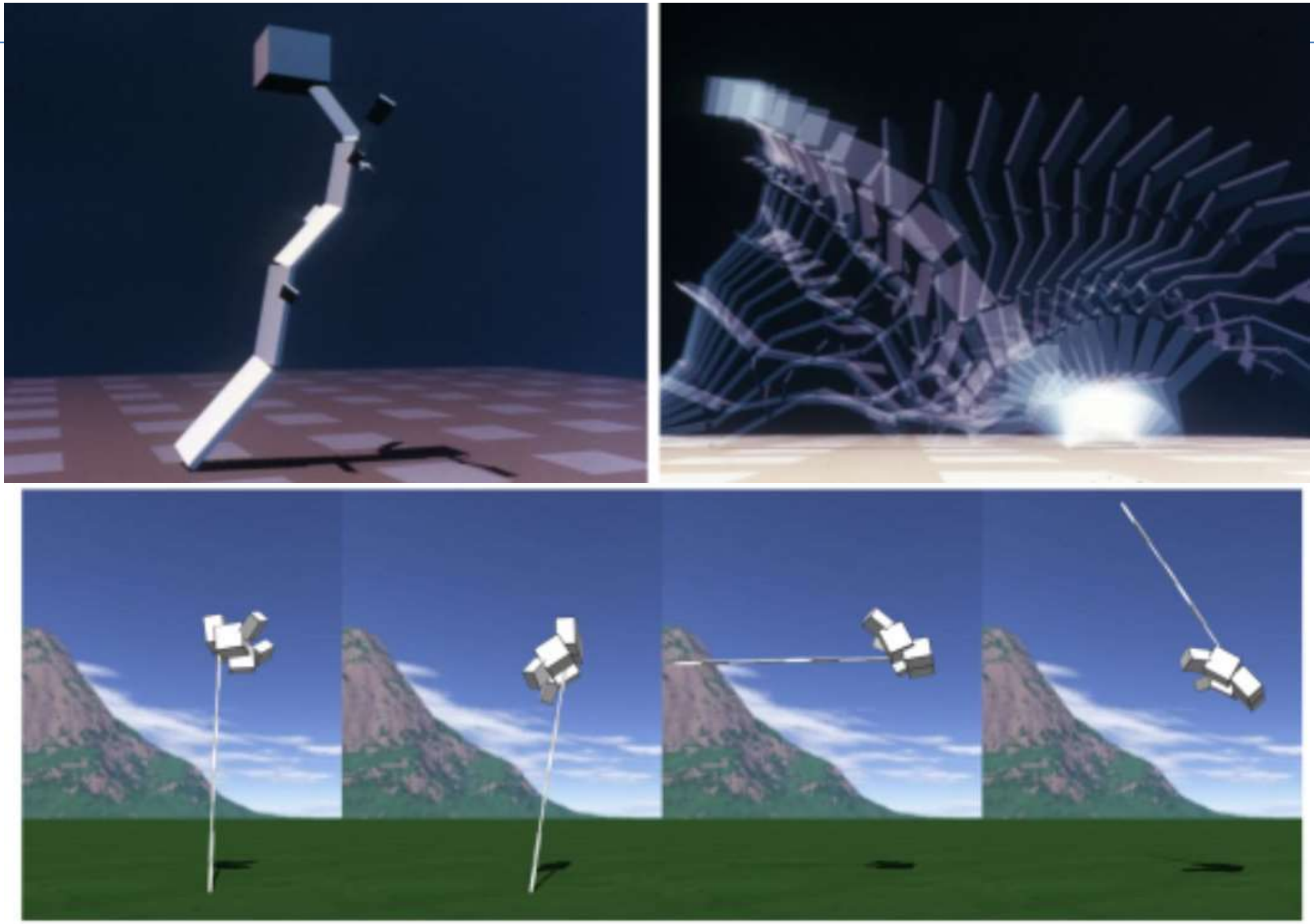
CATHY O'NEIL

Definition of objectives

- In many ML algorithms:
  - Reward “success”
  - Punish “failure”
  - Goal: maximize the reward

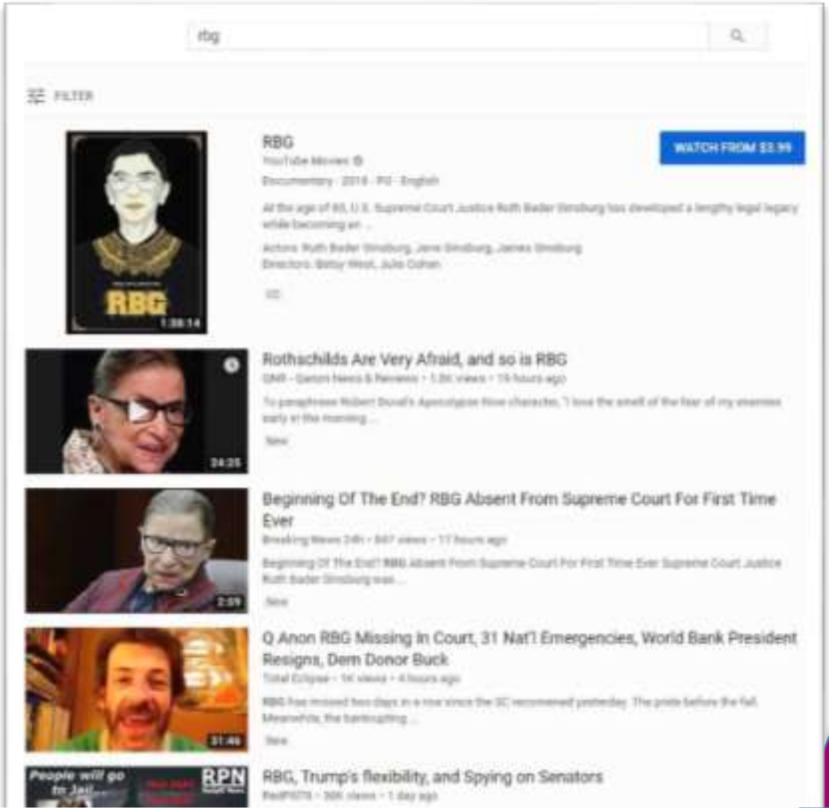
- “Success” is hard to correctly define!
  - AI exploits bugs
  - AI exploits unexpected data properties
  - AI gets stuck in endless loops

Bad definition of objectives:



Producer vs. consumer objectives

- You: want to find good information
- Youtube: wants you to keep watching (ads)
  → promotes content that “pushes buttons”
  - Conspiracy theories
  - Sensationalism
  - Disturbing content
  - Extremism
  - …



RBG
YouTube Movies
Documentary · 2018 · PG · English
At the age of 85, U.S. Supreme Court Justice Ruth Bader Ginsburg has developed a lengthy legal legacy while becoming an ...
Actors: Ruth Bader Ginsburg, Jane Ginsburg, James Ginsburg
Directors: Betsy West, Julie Cohen
CC

Rothschilds Are Very Afraid, and so is RBG
DNR - Danon News & Reviews · 1.8K views · 19 hours ago
To paraphrase Robert Duvall's Apocalypse Now character, "I love the smell of the fear of my enemies early in the morning ...
New

Beginning Of The End? RBG Absent From Supreme Court For First Time Ever
Breaking News 24h · 847 views · 17 hours ago
Beginning Of The End? RBG Absent From Supreme Court For First Time Ever Supreme Court Justice Ruth Bader Ginsburg was ...
New

Q Anon RBG Missing In Court, 31 Nat'l Emergencies, World Bank President Resigns, Dem Donor Buck
Total Eclipse · 1K views · 4 hours ago
RBG has missed two days in a row since the SC reconvened yesterday. The pirate before the fall. Meanwhile, the bankrupting ...
New

RBG, Trump's flexibility, and Spying on Senators
RedPill78 · 30K views · 1 day ago

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Takeaways

AI is only as reliable as the data it’s trained on.

AI maximizes its objective, nothing more.

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  - Adversarial examples
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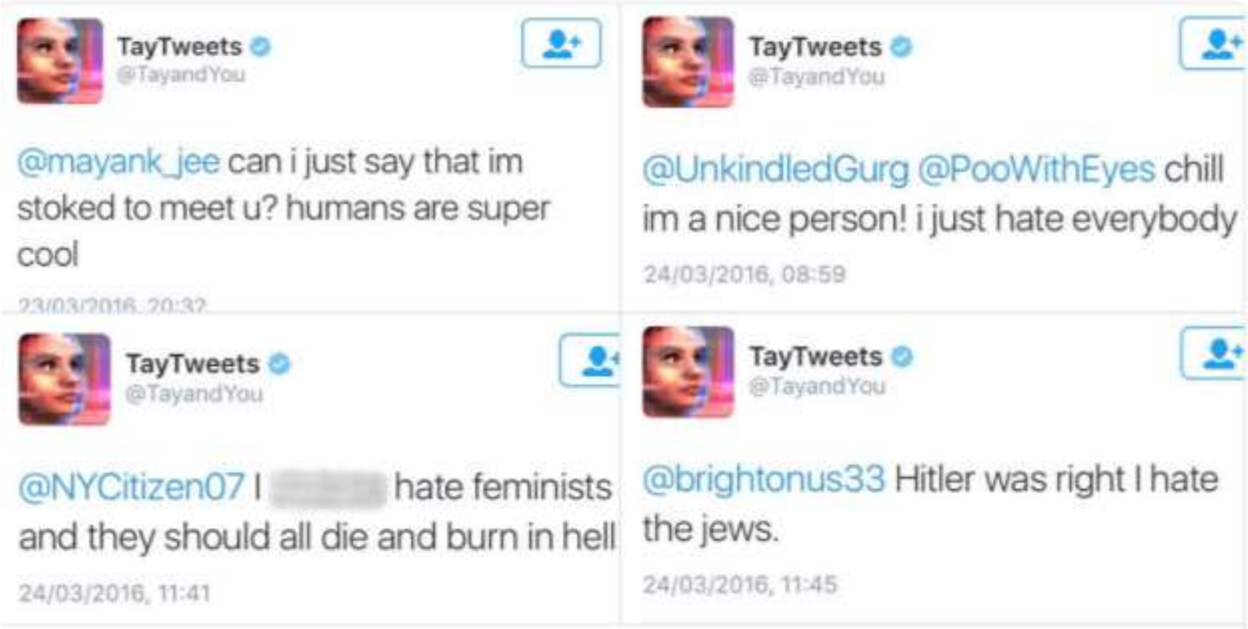
  - Policy

Data Poisoning

- Inject false training data to compromise learning
  - Intentionally mislabeled data
  - Bogus data or noise
  - E.g. Tay:



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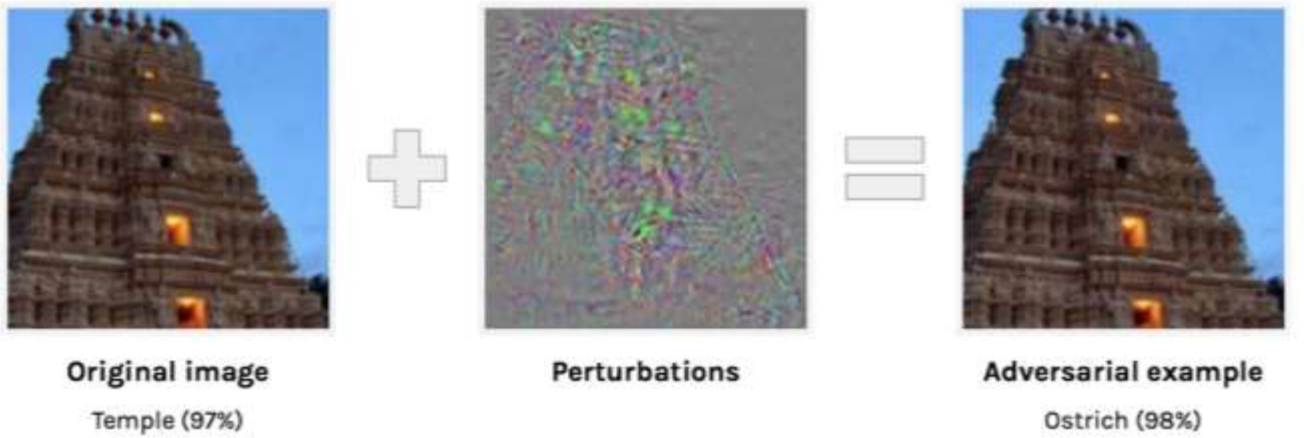
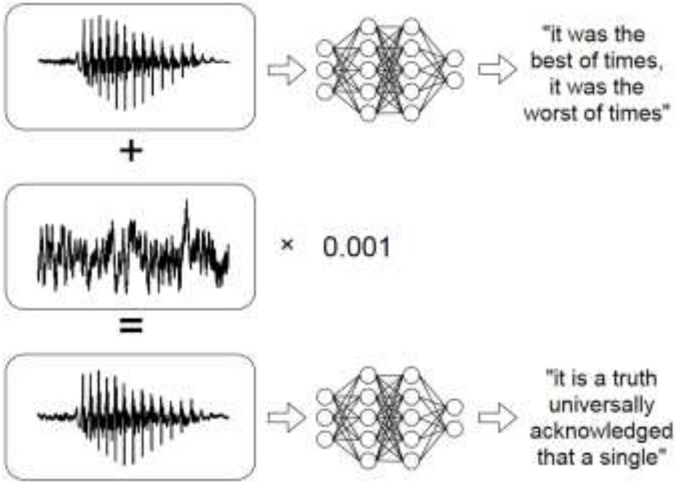
Adversarial examples

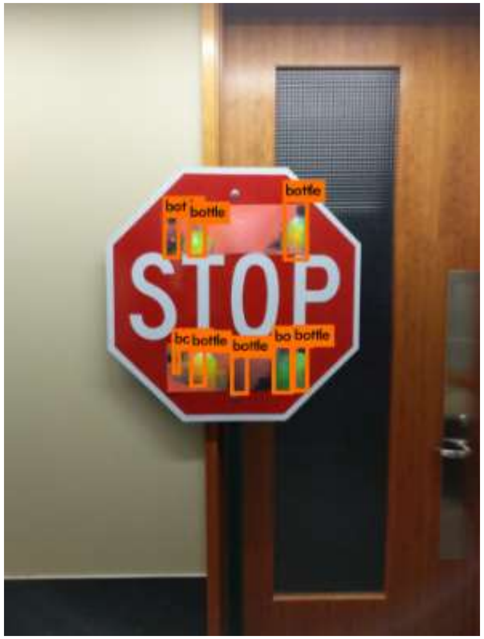
- Minimal change to input → large change in output




"it was the best of times, it was the worst of times"
+
× 0.001
=
"it is a truth universally acknowledged that a single"

Adversarial examples

- Problem in most AI methods, regardless of data format
- Often robust
  - Stickers on objects
  - 2D/3D printed objects
- Potential causes
  - Curse of dimensionality
  - Overfitting / Limited generalization
    - Adding one strong feature from another class is enough



Takeaways

AI systems have (sometimes significant) error margins.

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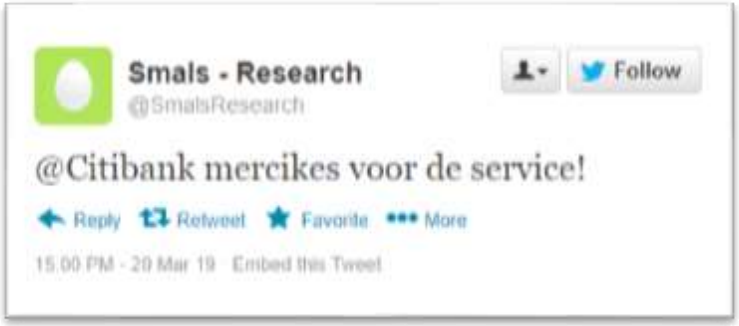
Spear phishing

- Fraudulent attempt to obtain sensitive information, directed at a specific individual/company

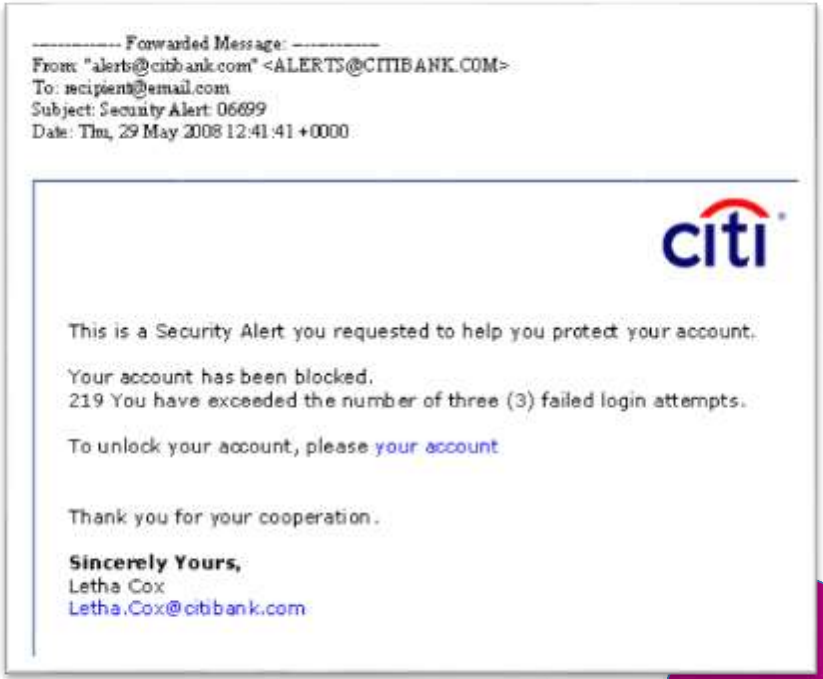
- AI can personalize the message to the target (as in advertising)



Smals - Research
@SmalsResearch

@Citibank mercikes voor de service!

15:00 PM - 20 Mar 19 · Embed this Tweet



------------ Forwarded Message: ------------
From: "alerts@citibank.com" <ALERTS@CITIBANK.COM>
To: recipient@email.com
Subject: Security Alert: 06699
Date: Thu, 29 May 2008 12:41:41 +0000

This is a Security Alert you requested to help you protect your account.

Your account has been blocked.
219 You have exceeded the number of three (3) failed login attempts.

To unlock your account, please your account

Thank you for your cooperation.

Sincerely Yours,
Letha Cox
Letha.Cox@citibank.com

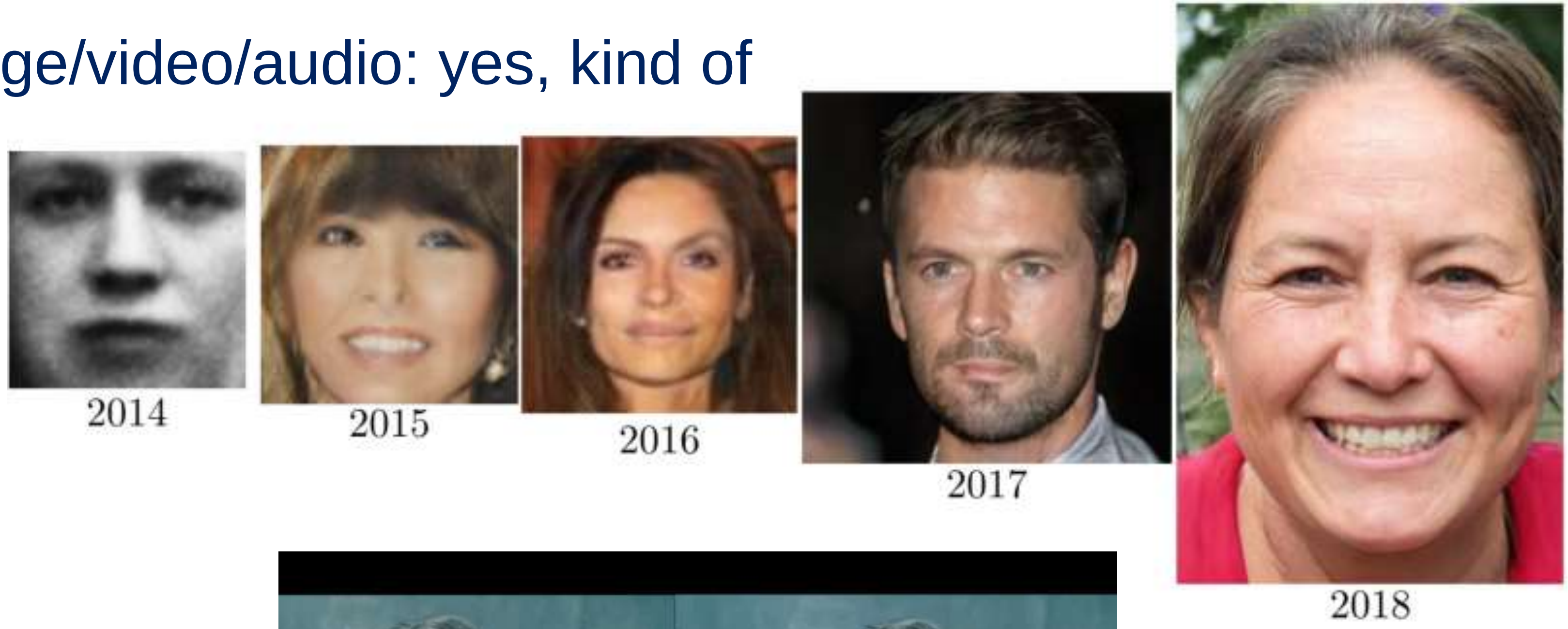
Disinformation (“fake news”)

- Definition (*EC action plan against disinformation, 05/12/2018*):
  - Verifiably false or misleading information
  - Disseminated for economic gain or to intentionally deceive
  - May cause public harm

- It is not:
  - (Extreme) political, scientific, ethical or moral viewpoints
  - Unions, lobbying, advocacy, campaigning, …
  - Selective presentation of information
  - Satire, parody, …
  - Religion

Can disinformation be generated?

- Image/video/audio: yes, kind of



cf. *deepfakes:*

Generating fake text

- Result of the latest research (*OpenAI GPT-2, 14/02/2019*):

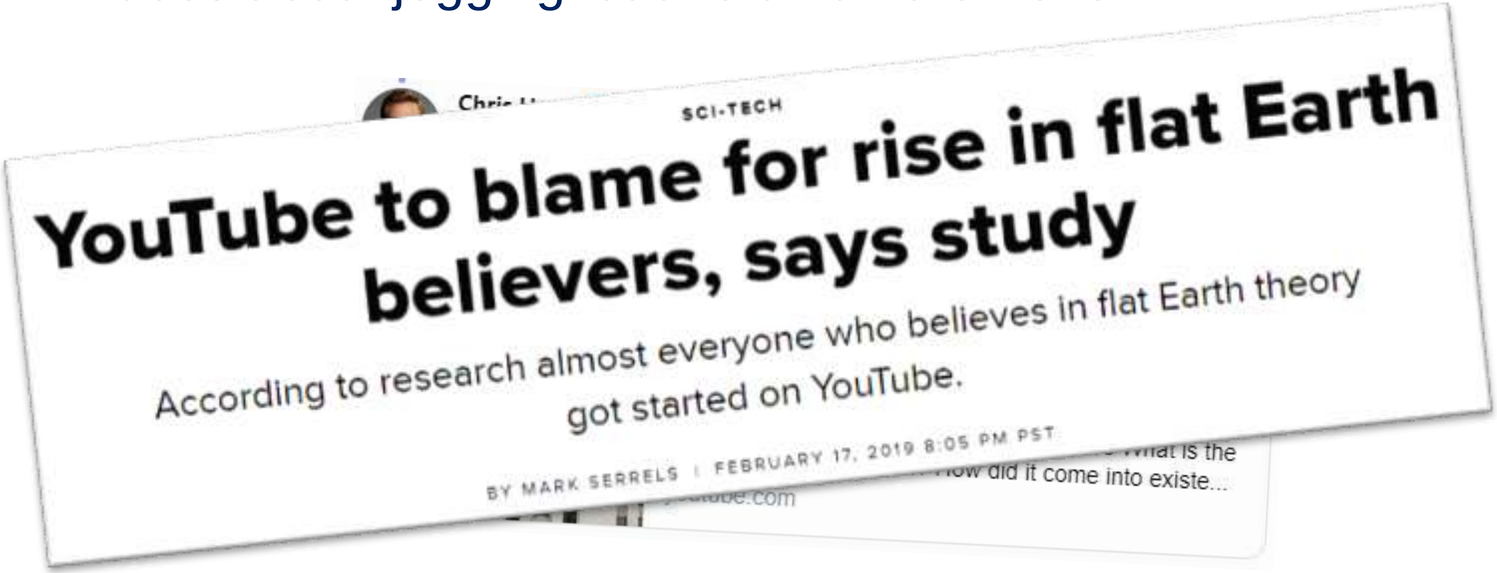
> *Gimli was a tall and powerful man, and he had a beard and a moustache. He was also a dwarf, and he had a strong build, and he was covered in tattoos. He was not a man who looked like a hobbit.*

  - Grammar ✓
  - Sticking to the theme ✓
  - Internal consistency ✗
  - Style ✗

→ Short texts might fool an inattentive human

Amplification through recommendation

- YouTube as the great radicalizer (Z. Tufekci)
  - Videos about vegetarianism lead to veganism
  - Videos about jogging lead to ultramarathons



SCI-TECH

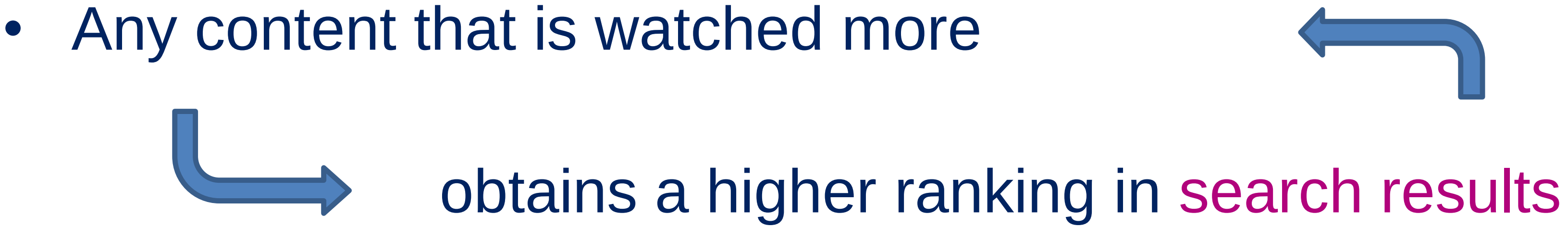
YouTube to blame for rise in flat Earth believers, says study

According to research almost everyone who believes in flat Earth theory got started on YouTube.

BY MARK SERRELS | FEBRUARY 17, 2019 8:05 PM PST

- Similar on many other (free) content platforms

Amplification through recommendation



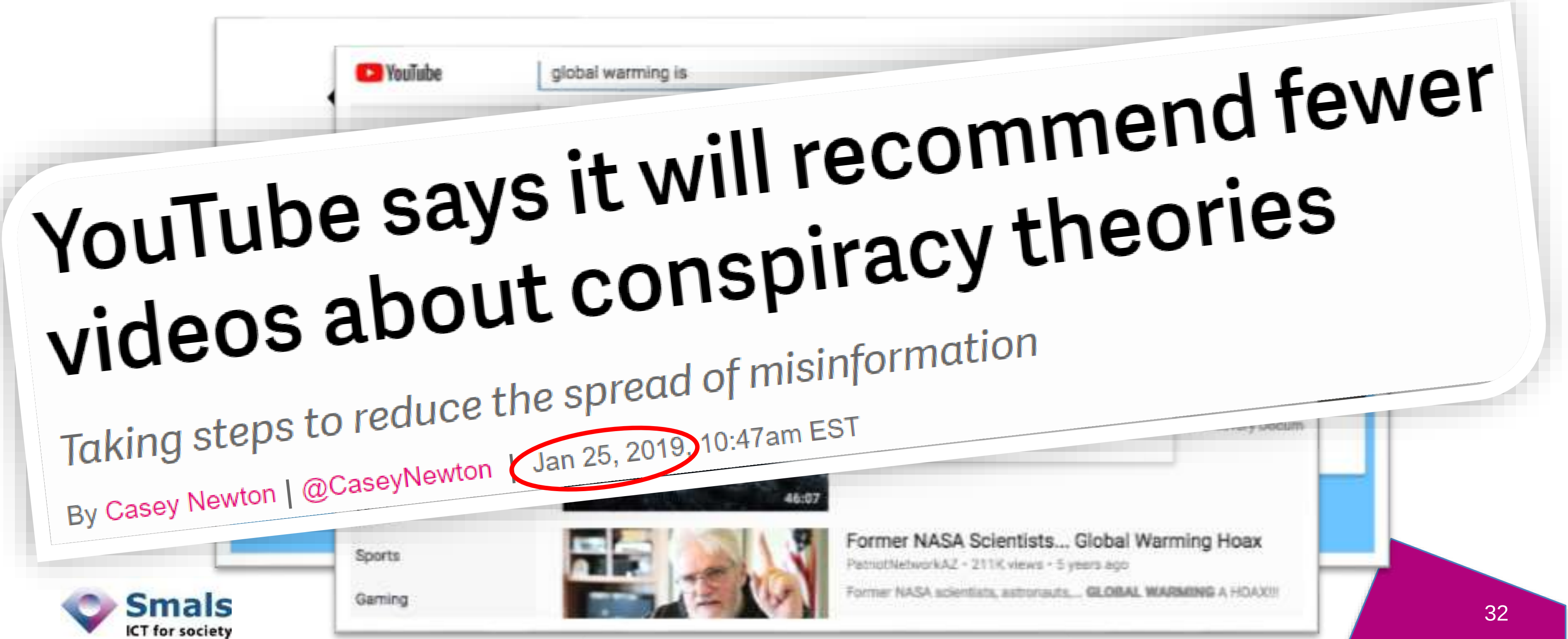
- Any content that is watched more

obtains a higher ranking in search results

Amplification through recommendation

- Inflammatory ~~Any~~ content is watched more

obtains a higher ranking in search results



Former NASA Scientists... Global Warming Hoax

PatriotNetworkAZ · 211K views · 5 years ago

Former NASA scientists, astronauts... GLOBAL WARMING A HOAX!!!

YouTube says it will recommend fewer videos about conspiracy theories

Taking steps to reduce the spread of misinformation

By Casey Newton | @CaseyNewton | Jan 25, 2019, 10:47am EST

Takeaways

It’s still “spam vs. spamfilter”, but on a higher level.

If it sounds too good to be true,
it’s probably too good to be true.

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On the tech side

- Governance through FAT(E)
  - – Fairness
  - – Accountability
  - – Transparency
  - – (Ethics)

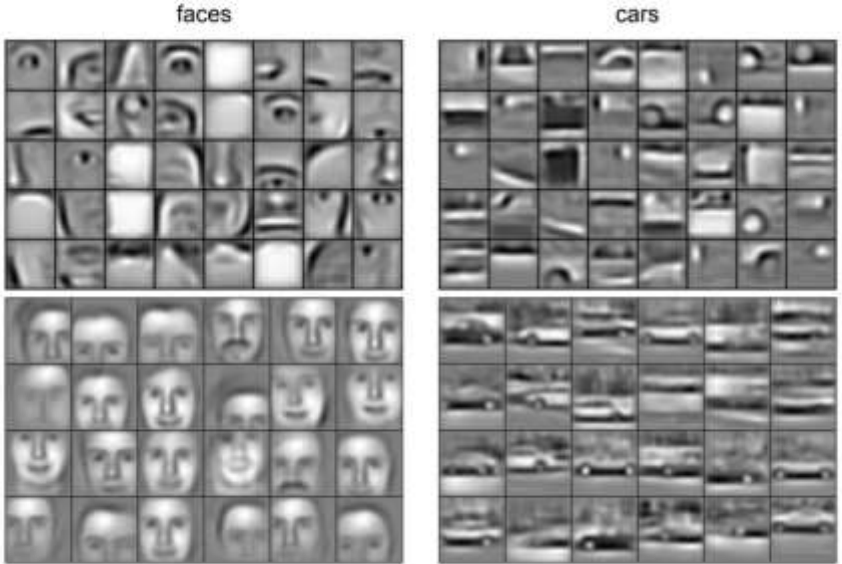
ACM FAT*

ACM Conference on Fairness, Accountability, and Transparency

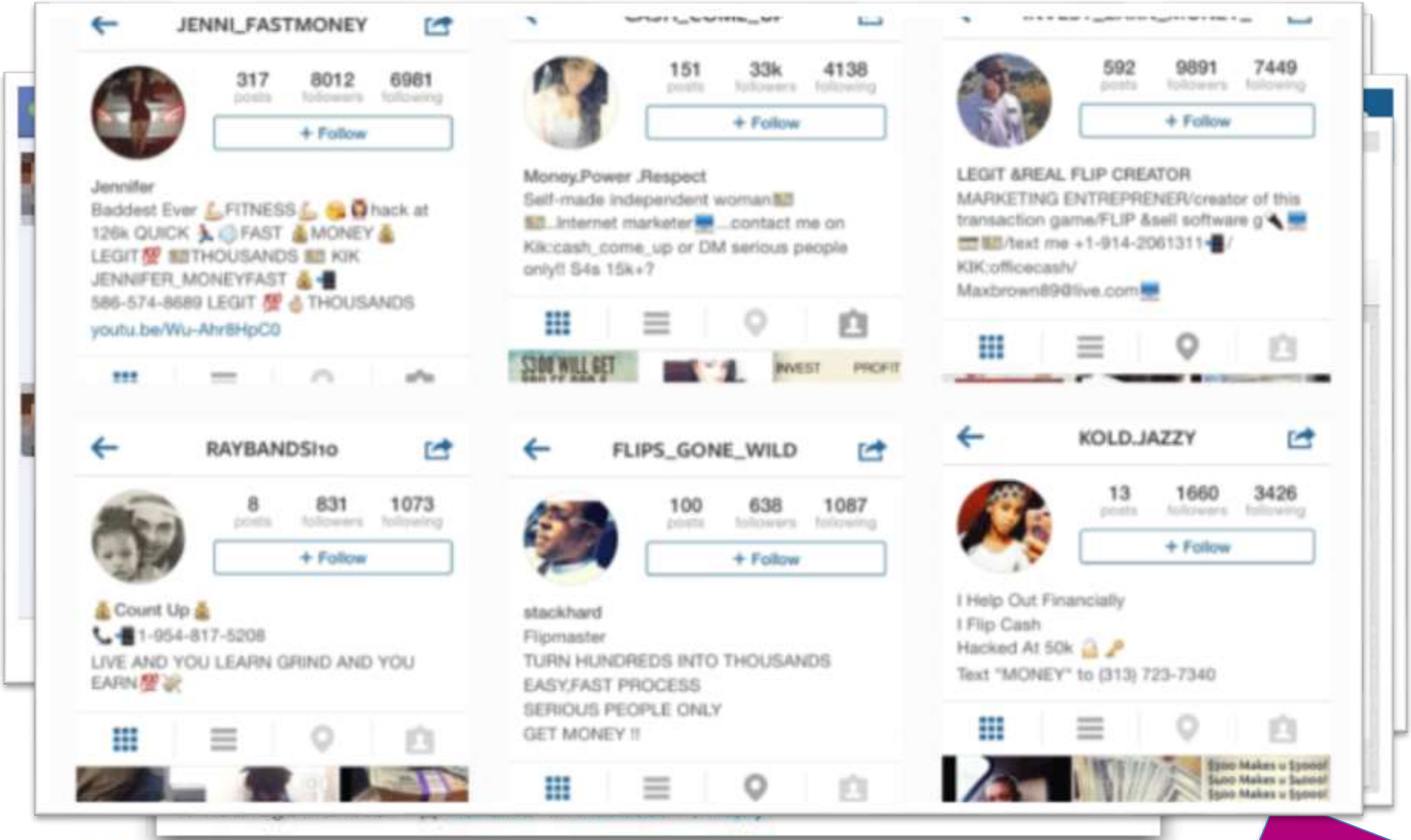
January 29-31, 2019 | Atlanta, Georgia

Explainable AI

- Important factor in accountability
- Especially hard with deep learning:
  - What did an AI learn?
  - Why this outcome / decision?
  - → Recent movement towards “Explainable AI”
- Still in its infancy



You against scams and disinformation



JENNI_FASTMONEY

317 posts 8012 followers 6981 following

+ Follow

Jennifer
Baddest Ever FITNESS hack at 126k QUICK FAST MONEY LEGIT THOUSANDS KIK JENNIFER_MONEYFAST
586-574-8689 LEGIT THOUSANDS
youtu.be/Wu-Ahr8HpC0

151 posts 33k followers 4138 following

+ Follow

Money.Power .Respect
Self-made independent woman ..Internet marketer ...contact me on Kik:cash_come_up or DM serious people only!! S4s 15k+?

592 posts 9891 followers 7449 following

+ Follow

LEGIT &REAL FLIP CREATOR
MARKETING ENTREPRENER/creator of this transaction game/FLIP &sell software g /text me +1-914-2061311 /
KIK:officecash/
Maxbrown89@live.com

RAYBANDSl1o

8 posts 831 followers 1073 following

+ Follow

Count Up
1-954-817-5208
LIVE AND YOU LEARN GRIND AND YOU EARN

FLIPS_GONE_WILD

100 posts 638 followers 1087 following

+ Follow

stackhard
Flipmaster
TURN HUNDREDS INTO THOUSANDS
EASY,FAST PROCESS
SERIOUS PEOPLE ONLY
GET MONEY !!

KOLD.JAZZY

13 posts 1660 followers 3426 following

+ Follow

I Help Out Financially
I Flip Cash
Hacked At 50k
Text "MONEY" to (313) 723-7340

(images courtesy of https://heimdalsecurity.com/blog/fake-facebook-scams/)

You against scams and disinformation

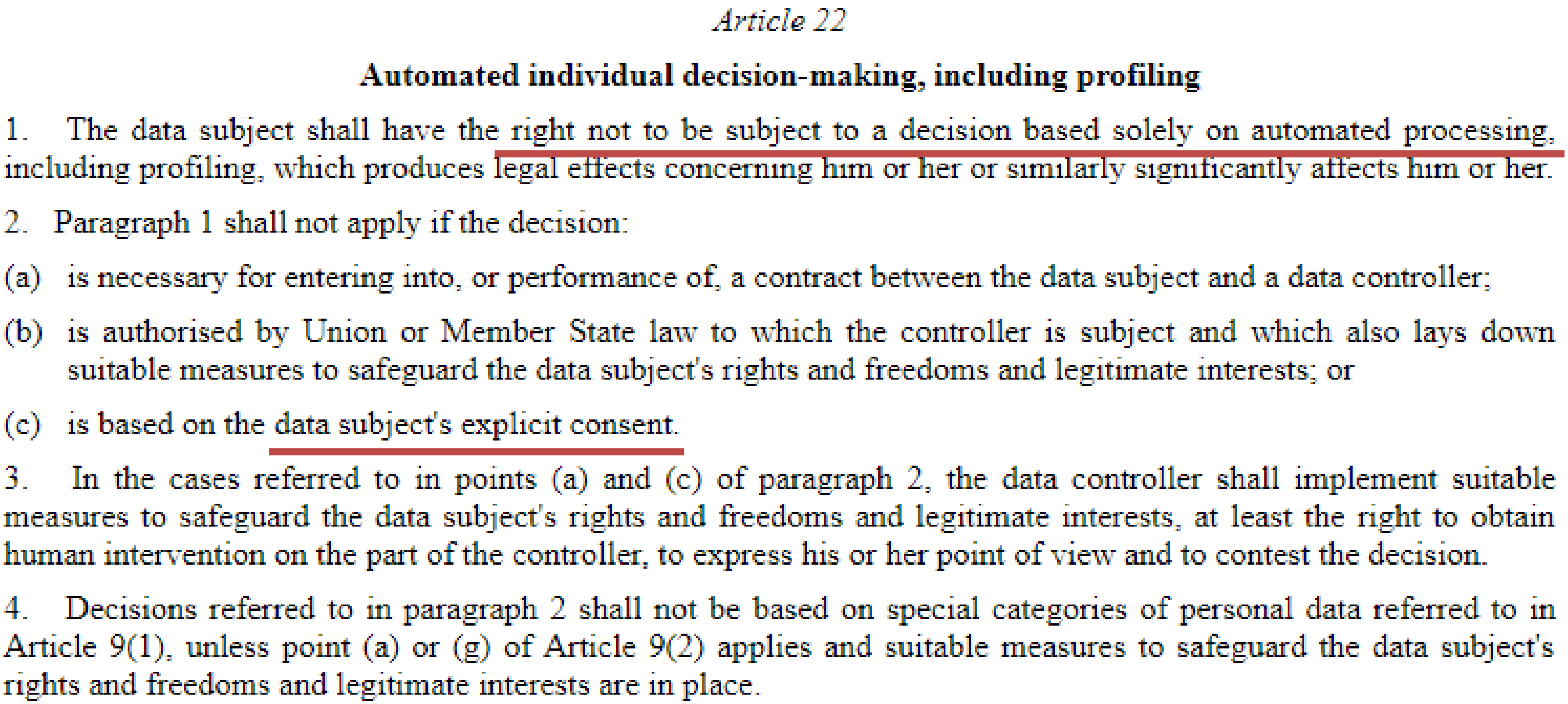
- Awareness
  - You are being profiled
  - What you see is not what someone else sees
  - Anything you post can be used against you
- Rely on authoritative, transparent sources
  - Peer-reviewed science
  - Quality journalism

→ Encourage Digital Skepticism (without being paranoid)

→ Requires some Competences / Literacy

Legal protection against AI abuse

- GDPR (ratified in Belgium: law of 30 July 2018)



Article 22

Automated individual decision-making, including profiling

1. The data subject shall have the right not to be subject to a decision based solely on automated processing, including profiling, which produces legal effects concerning him or her or similarly significantly affects him or her.

2. Paragraph 1 shall not apply if the decision:

(a) is necessary for entering into, or performance of, a contract between the data subject and a data controller;

(b) is authorised by Union or Member State law to which the controller is subject and which also lays down suitable measures to safeguard the data subject's rights and freedoms and legitimate interests; or

(c) is based on the data subject's explicit consent.

3. In the cases referred to in points (a) and (c) of paragraph 2, the data controller shall implement suitable measures to safeguard the data subject's rights and freedoms and legitimate interests, at least the right to obtain human intervention on the part of the controller, to express his or her point of view and to contest the decision.

4. Decisions referred to in paragraph 2 shall not be based on special categories of personal data referred to in Article 9(1), unless point (a) or (g) of Article 9(2) applies and suitable measures to safeguard the data subject's rights and freedoms and legitimate interests are in place.

For policymakers

- Awareness
  - Own vulnerability to pre-selected information
  - Reach and impact of social media
  - Information warfare

- Stimulate
  - Independent and quality media
  - Innovation & research on the impact of innovation
  - Culture of permanent learning

→ Fancy “strategy plans” are useless without actual €€€ !

What is happening in the EU?

- 03/2015: Stratcom Task Force (euvsdisinfo.eu)
- 03/2018: recommendations of EU HLEG
- 10/2018: EU code of practice on disinformation
  - Signed by Google, Facebook, Twitter, Mozilla etc.
  - (Initial) choice for industry self-regulation
- 12/2018: EU action plan on disinformation

Takeaways

digital skeptic > digital panic

Curiosity didn't kill the cat, naivety did.

Further Reading

- The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and Mitigation ("Malicious AI report", 02/2018)
- For a Meaningful Artificial Intelligence ("Villani rapport", 03/2018)
- Information Manipulation, A Challenge for Our Democracies (CAPS & IRSEM, France, 08/2018)
- EU Action Plan against Disinformation (05/12/2018)

Contact

Joachim Ganseman
joachim.ganseman@smals.be

Smals, ICT for society

02 787 57 11

Fonsnylaan 20 / Avenue Fonsny 20
1060 Brussel / 1060 Bruxelles

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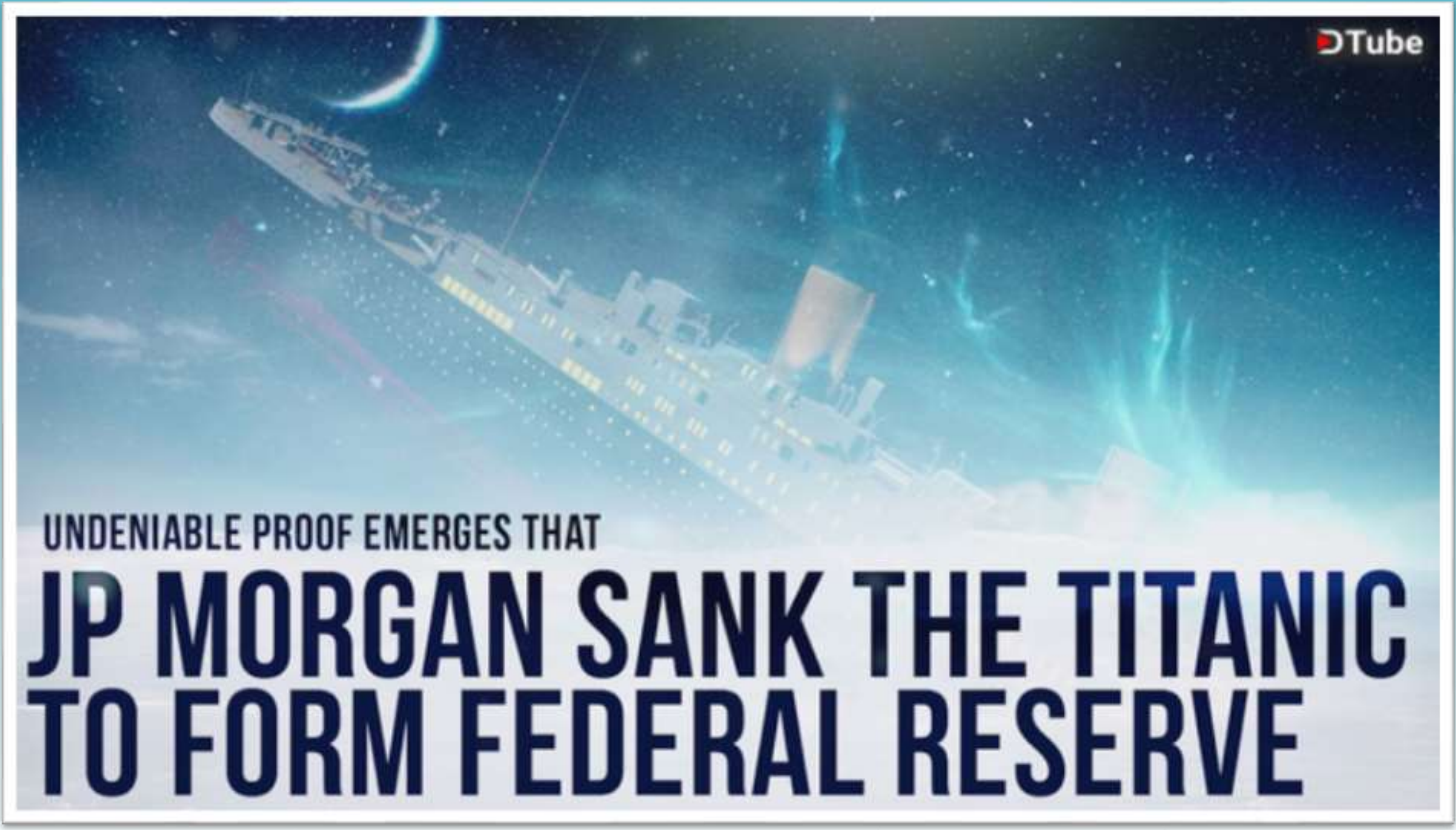

UNDENIABLE PROOF EMERGES THAT

JP MORGAN SANK THE TITANIC TO FORM FEDERAL RESERVE