The Significance of Data Science Ethics

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Statistically Speaking
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A story from my early teaching years

- Engineering professor class assignment:
  - Design a pipeline to send blood from a poor developing nation to a rich developed one.
- The students got to work…
- Professor: “Why didn’t you question the ethics”?

- “This is a class in engineering not ethics,” was the answer the students gave.

Moral of the Story

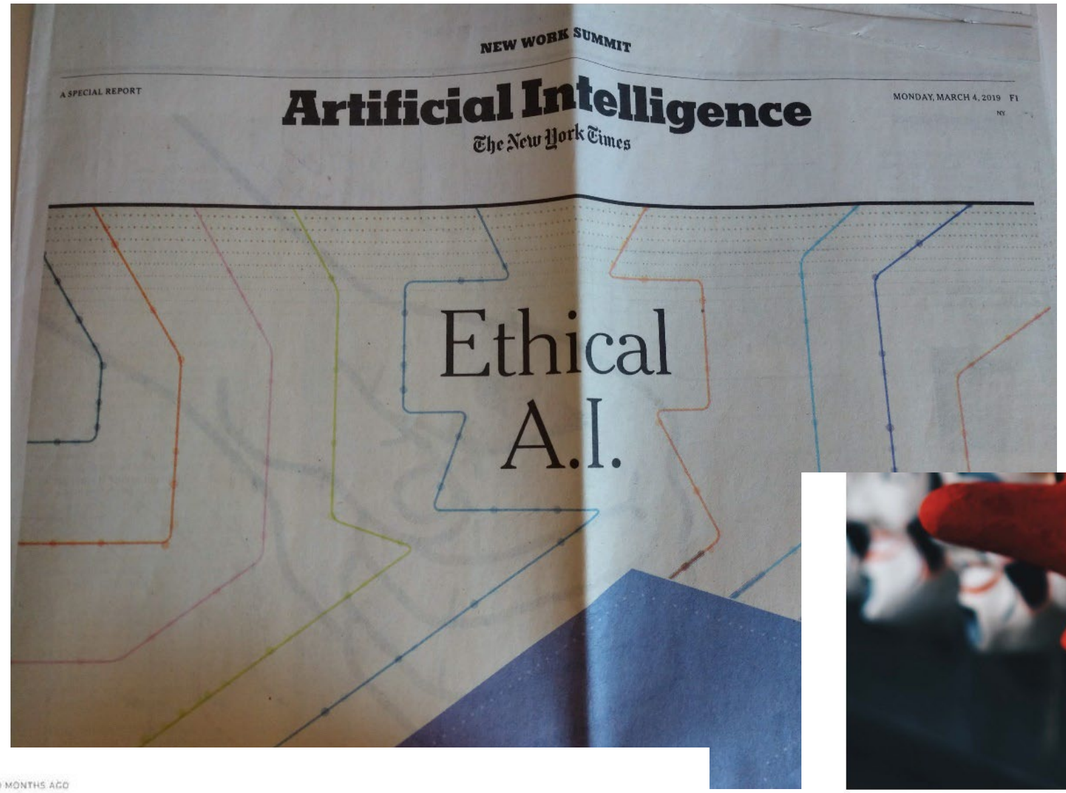
- Ask *WHY* before asking *how*.
- Is the task ethical? Are there pros and cons?
- Who might benefit? Who might suffer?

Example: GPS Map program

Is it ethical…

- To clog roads by sending everyone on the same route when leaving a large event?
- To send cars through high-crime areas?
- To even identify high-crime areas?
- To send pedestrians through high-crime areas?
- To increase traffic in residential areas?
- What about school zones?

Ethics of Data Science is in the News!



When artificial intelligence decides who's worthy, who's right, and who's criminal, you can only hope it makes the right call.

BUSINESS NEWS OCTOBER 9, 2018 / 8:12 PM / 10 MONTHS AGO

Amazon scraps secret AI recruiting tool that showed bias against women

Jeffrey Dastin 8 MIN READ

SAN FRANCISCO (Reuters) - Amazon.com Inc's (AMZN.O) machine-learning specialists uncovered a big problem: their new recruiting engine did not like women.

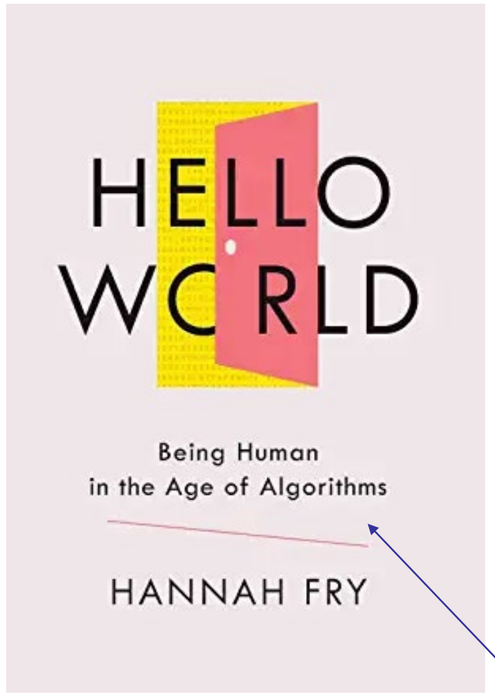
Why AI Must Be Ethical — And How We Make It So

When artificial intelligence decides who's worthy, who's right, and who's criminal, you can only hope it makes the right call.

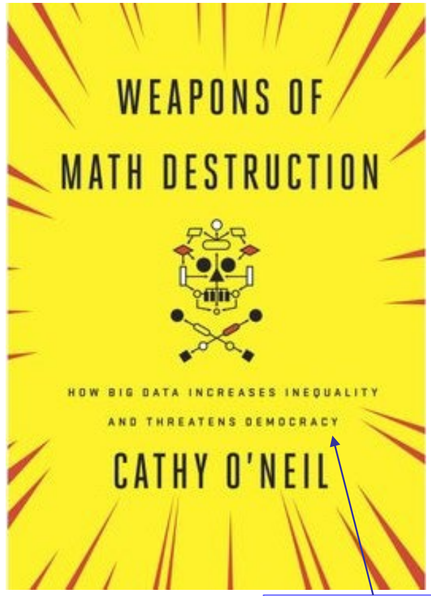
Jacob Bergdahl Follow
Jul 14 · 7 min read ★

It's 2021. The rain is pleasantly pouring outside. You're having an afternoon tea, while working on your next project on your laptop. Your workflow is interrupted by a phone call. It's Danielle from Subtling. You were there last Friday on a job interview that you're

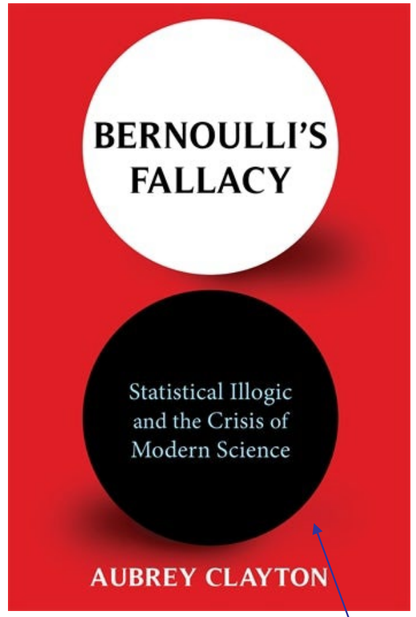
And in books…



Being human in the age of algorithms



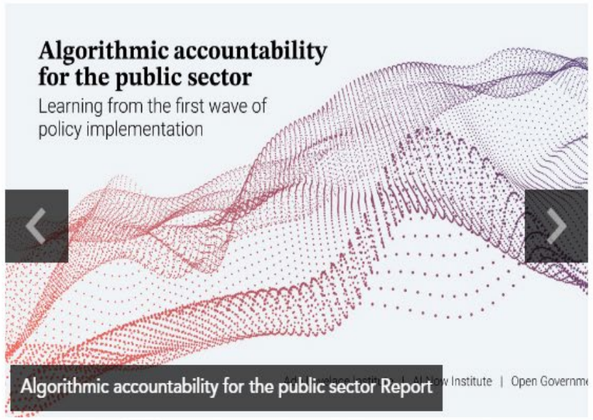
How big data increases inequality and threatens democracy



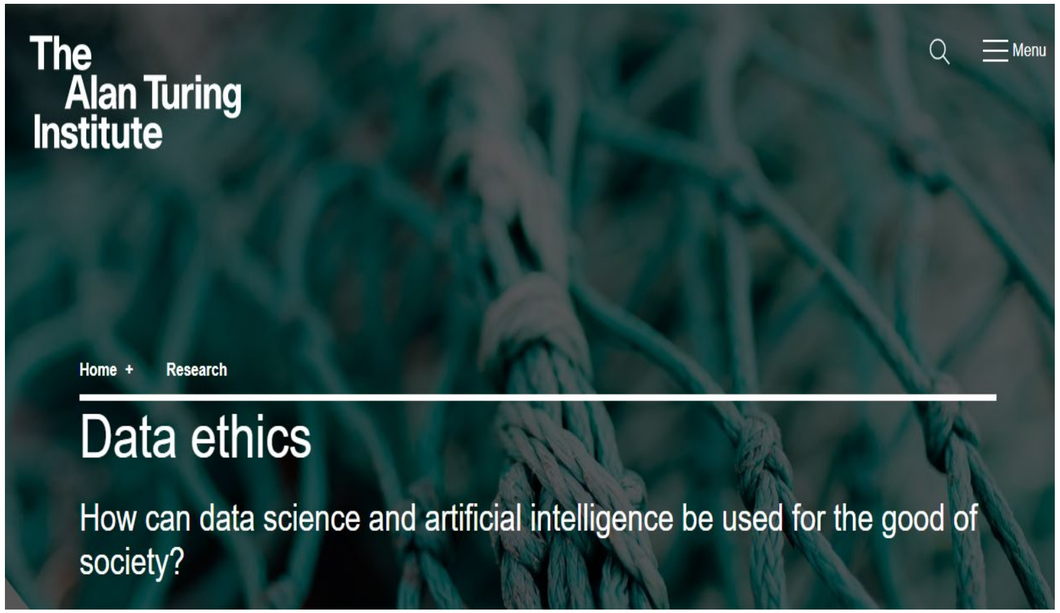
Statistical illogic and the crisis of modern science

And in Institutes…

The **AI Now Institute at New York University** aims to produce interdisciplinary research and public engagement to help ensure that AI systems are accountable to the communities and contexts in which they're applied.



Our mission is to produce rigorous, interdisciplinary, and strategic research to inform public discourse around the social implications of AI.



Professional Societies Weigh In…

Institute and Faculty of Actuaries

ROYAL STATISTICAL SOCIETY
DATA | EVIDENCE | DECISIONS

A Guide for Ethical Data Science

A collaboration between the Royal Statistical Society (RSS) and the Institute and Faculty of Actuaries (IFoA)

International Statistical Institute

Statistical Science for a Better World

Members only

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Professional ethics

In this section:

- Mission & Objectives
- Statutes and By-Laws
- Strategic Plans
- Policies »
- Members
- Executive Committee
- Council
- Staff (the PO)
- Professional Ethics
- Awards
- History

The ISI is concerned to raise and maintain professional ethical standards in statistics across the world.

As a Non-Government Organization (NGO) ISI can take actions which may be politically difficult for other organisations. We have adopted the *ISI Declaration on Professional Ethics* and set up an Advisory Board on Ethics to advise on compliance with the Declaration. The ISI considers submissions on ethical issues, issues statement and works with other organisation to raise and maintain ethical standards within the statistics profession.

» ISI Declaration on Professional Ethics «

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Ethical Guidelines for Statistical Practice

Prepared by the Committee on Professional Ethics of the American Statistical Association

January 2022

PDF Download

Why is there so much attention now?

- The abundance of data!
- Lack of quality control and transparency
- Traditional ethical issues for statisticians
  - Ethical Guidelines from professional societies (ASA, RSS, ISI)
- Not enough. New complexity => new ethical issues

AI ethics examples: Facial recognition

Amazon's Face Recognition Falsely Matched 28 Members of Congress With Mugshots

By Jacob Snow, Technology & Civil Liberties Attorney, ACLU of Northern California

JULY 26, 2018 | 8:00 AM

TAGS: Face Recognition Technology, Surveillance Technologies, Privacy & Technology

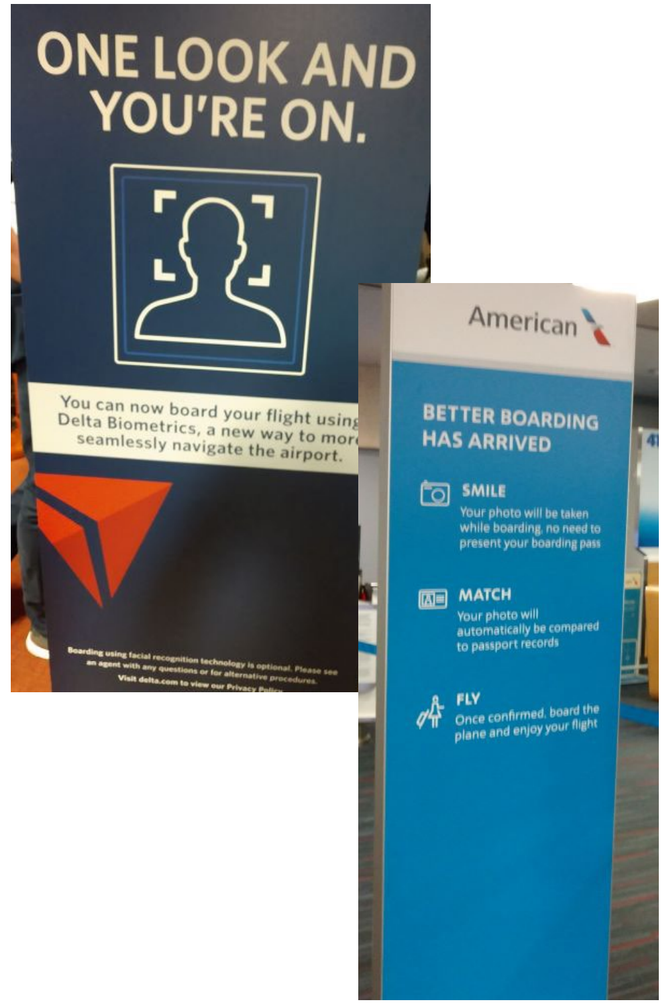
28/535 = 5.2%

https://www.aclu.org/blog/privacy-technology/surveillance-technologies/amazons-face-recognition-falsely-matched-28

https://aws.amazon.com/rekognition/

Facial recognition software: Benefit/risk tradeoffs

- Boarding airplanes, verifying banking customers, etc.
- Finding celebrities in surveillance videos
- Used by police to find [possible] criminals
- Has resulted in false convictions, and even deaths.
- Less reliable for people of color and women. Especially bad for children.



Other classic AI ethics examples

- Hiring algorithms
- Criminal recidivism
- Loan eligibility
- Medical diagnostic algorithms
- But, are they better or worse than humans??

Some Important Data Science Ethical Guidelines

- Transparency. No “black box” credibility.
- Don’t ignore uncertainty.
- Consider bias in data sources.
- Entire team responsible for ethical issues.
- Humans should always be involved.
- Correlation does not imply causation.
  - Algorithms can suggest intervention action.

Areas of ethical concerns for statisticians

- Data collection, quality, and uses
- Implementation of details in a study
- Analysis
- Reporting results
  - To clients
  - To the media and the public
- Teach statistical literacy

Facebook/Cornell Emotion Study

- 2012 study, randomly selected 689,003 Facebook users, assigned to 4 groups.
- No informed consent!
- Groups:
  - Negative news feed reduced
  - Positive news feed reduced
  - 2 control groups; news feed randomly omitted
- Use of negative and positive words in subjects' own posts measured; study lasted one week

Results from Cornell press release

“News feed: Emotional contagion sweeps Facebook”

- “People who had positive content experimentally reduced on their Facebook news feed for one week used more negative words in their status.”
- “When news feed negativity was reduced the opposite pattern occurred. Significantly more positive words were used in peoples’ status updates.”

https://news.cornell.edu/stories/2014/06/news-feed-emotional-contagion-sweeps-facebook

Lots of publicity

- Published in the *Proceedings of the National Academy of Sciences*, June 2014
- According to Altmetric data:
  - Mentioned by 337 news outlets
  - 136 blogs
  - 4164 tweeters

BUT, the actual results…

"When positive posts were reduced in the News Feed, the percentage of positive words in people's status updates decreased by 0.1% compared with control [t(310,044) = −5.63, P < 0.001, Cohen's d = 0.02], whereas the percentage of words that were negative increased by 0.04% (t = 2.71, P = 0.007, d = 0.001)."

Positive Words (per cent)
5.4
5.3
5.2
5.1
5.0
Control
Experimental
Negativity Reduced
Positivity Reduced
Negative Words (per cent)
1.50
1.60
1.70
1.80

Authors' justification…

- Given the massive scale of social networks such as Facebook, even small effects can have large aggregated consequences.
- And after all, an effect size of d = 0.001 at Facebook's scale is not negligible: In early 2013, this would have corresponded to hundreds of thousands of emotion expressions in status updates per day."

Ethical Issues from this Study

- No informed consent.
- Misleading graphs.
- Confusion of statistical significance with practical significance (importance)
- Justification of small effect size as being of practical importance because of large population affected.

Ethics of Reporting Results

- Focus on magnitude, not p-values.
  - With big data, small effects have tiny p-values
  - With small data sets, large effects can have $p >> .05$
  - Replication should consider magnitude of effects, not statistical significance.

I've been making this point for many years – shirt courtesy of a colleague who handed them out at a conference where I spoke about this!

Ethics of Reporting Results, continued

- Include clear explanation of uncertainty.
  - Don’t just report point estimates
- Don’t overstate the importance of results.
- Graphics should be clear, not misleading.
- Don’t imply causal connection if not justified.
- Media and other reports should cover all relevant results, not just most interesting or surprising.

Some headline from observational studies

- 6 cups a day? Coffee lovers less likely to die, study finds *NBC News website*, 5/16/12
- Spanking lowers a child's IQ *LATimes*, 9/25/09
- Joining a Choir Boosts Immunity *Woman's World*, 6/27/16
- Walk faster and you just might live longer *NBC News website*, 1/4/11
  - Researchers find that walking speed can help predict longevity
  - The numbers were especially accurate for those older than 75

Example of misleading reporting: Hormone replacement therapy

- Women's Health Initiative, randomized study comparing hormones with placebo.
- Surprising result was *increase* in risk of coronary heart disease in hormone group.
- Trial was stopped early, and millions of women were advised to stop taking HRT (hormone replacement therapy) immediately.
- Large scale media attention on risks of heart disease and breast cancer from HRT.

But… Results from the original article

"Absolute excess risks per 10,000 person-years attributable to [hormones] were 7 more CHD [coronary heart disease] events, 8 more strokes, 8 more PEs [pulmonary embolism], 8 more invasive breast cancers, while absolute risk reductions per 10,000 person-years were 6 fewer colorectal cancers and 5 fewer hip fractures."

More results..

- 231 out of 8506 = 2.72% of women taking hormones died of any cause during the study.
- 218 of the 8102 = 2.69% of women taking placebo died of any cause during the study.
- Adjusted for the time spent in the study, the death rate was slightly lower in the hormone group, with an annualized rate of 0.52% compared with 0.53% in the placebo group.

Ethical issue for reporting these results

- The media and medical community focused on the surprising heart disease results
- In fact the hormone group fared *better* in many ways, including adjusted death rate.
- Were millions of women misled?
- If full results had been reported in the media, women could decide for themselves, for instance based on family or personal medical history.

Suggestions for Statistics Educators

- Train statistics students to think about ethics:
  - Propose and discuss ethical issues in class
  - Include ethics section in all data analysis assignments
  - Consider ethical implications throughout the cycle of data collection, analysis, reporting
  - Ask *why* before *how* for all assignments
- For all students, teach literacy issues such as:
  - Recognizing multiple analyses and selective reporting
  - Trade offs in society benefits versus personal rights
  - Confusing P(A | B) with P(B | A)

Prosecutor's Fallacy Example

Out of 6 million people, facial recognition software finds 6 people who match video from crime scene. One is on trial.

	Guilty	Innocent	Total
Match	1	5	6
No match	0	5,999,994	5,999,994
Total	1	5,999,999	6,000,000

- P(Innocent | match) = 5/6 (very high; used by defense lawyer)
- P(Match | innocent) = 5/5,999,999 (very low; used by prosecutor)

Summary and Conclusions

- Statistical analysts have a major role to play in data science ethics.
- Need to speak up as a member of an interdisciplinary team.
- Educators should teach ethics alongside technical issues in statistics programs.
- Teach all students to identify ethical issues and mistakes in reports based on statistical studies.

THANK YOU

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Related reference: Utts, Jessica (2021) "Enhancing Data Science Ethics Through Statistical Education and Practice," *International Statistical Review*, 89.1: 1-17.

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